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METROPOLITAN POPULATIONS TO 1985: TRIAL PROJECTIONS

Ira S. Lowry

The RAND Corporation
1700 MAIN ST • SANTA MONICA • CALIFORNIA • 90406

PREFACE AND ACKNOWLEDGMENTS

This inquiry began in 1963 as part of The RAND Corporation's Urban Transportation Study. The research was financed initially by a grant from The Ford Foundation, supplemented later by RAND corporate funds.

As work progressed, local and national planning agencies evinced considerable interest in our findings. Detailed tables of quinquennial projections were distributed to local agencies for review and comment, and these agencies in turn supplied data for this study and other concurrent studies at RAND. The present Memorandum provides a methodological and statistical background for local users of the detailed tables, and a convenient summary for others whose interests or perspectives are national rather than local.

A number of sources outside RAND aided in the preparation of these projections. The principal machine computational program was adapted from one prepared by [illegible]. Albert Chevan of the Penn-Jersey Transportation Study, who also furnished a method and data for the projection of vital rates. Staff members of the National Vital Statistics Division, U. S. Department of Health, Education, and Welfare, were helpful with mortality data. The Population Estimates and Projections Branch of the U. S. Bureau of the Census furnished unpublished data and other assistance relating to the preparation of component estimates of net migration. Mr. Meyer Zitter of the Bureau of the Census was kind enough to read and comment on a draft of the present study; his remarks did much to improve the final version.

The staffs of a number of city, metropolitan, and state planning agencies reviewed population projections pertaining to their localities, and supplied local data for use by RAND. A special debt is due to Miss Evelyn Mann and Mr. Alfred Shapiro of the City Planning Commission of New York, whose careful review of preliminary tabulations for the New York SMSA uncovered a serious error in data processing.

The persons and agencies named above do not necessarily endorse the study's findings or implications. Final responsibility for all methods, data, and conclusions rests with the author.

SUMMARY

This study summarizes the results of two series of demographic projections covering each of the 52 largest Standard Metropolitan Statistical Areas (SMSA) in the United States. These are trial projections, the first steps in a continuing effort to anticipate the probable sizes and characteristics of future metropolitan populations.

For each SMSA, the 1960 population was divided into 60 components (age, by sex and color); on the basis of explicit and detailed assumptions as to rates of birth, death, and migration, the size of each component is estimated at five-year intervals, 1960-1985. The results are compared to national projections prepared by the Bureau of the Census, and to SMSA projections prepared by various local agencies.

Like all projections, these are no better than the assumptions on which they are based; but these assumptions are sufficiently plausible so that their implications for metropolitan growth are of general interest. The principal findings are summarized below.

In 1960, the U.S. Census listed 52 Standard Metropolitan Statistical Areas whose populations exceeded half a million persons. These SMSA's contained a total of 80 million inhabitants, or 45 per cent of the nation's people. Assuming continued migration in the pattern of 1950-1960, the same 52 SMSA's will contain 100 million inhabitants by 1970, with a probable 124 million by 1980.

Twenty-four of these SMSA's reported a million inhabitants or more in 1960; by 1970, we may expect at least 30 such places, and at least 40 by 1980. New York and Los Angeles SMSA's will each contain about 13 million people in 1980, as compared with 10.7 and 6.7 millions, respectively, in 1960.

Yet these projections do not represent a very great advance in the metropolitanization of the nation's people; the 52 largest SMSA's would be growing only slightly faster than the nation as a whole. (It may be, however, that the smaller SMSA's not included in this list would grow more rapidly than the large ones.) The projections do imply an important geographical redistribution of metropolitan populations,

with some industrial cities of the East Coast and Great Lakes Regions losing their places in the hierarchy of metropolises to newcomers of the South and West. Also implied are important shifts in the ethnic composition and age structure of the metropolitan populations--shifts which will profoundly affect the conditions of metropolitan life.

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I. INTRODUCTION

This study is concerned with the 52 largest SMSA's of the continental United States,* containing 80 million inhabitants in 1960. These places, all over 500,000 population, serve as prime subjects for the jeremiads which issue regularly from civic leaders, journalists, and academicians, bemoaning administrative confusion, failures of social discipline, growth of slums, air pollution, deterioration of services, traffic jams, esthetic disorder, social distance, and (lately) racial friction. These places are also most of them, highly plausible targets for nuclear attack; their inhabitants rely on elaborate social and physical arrangements for the basic necessities of life--food, fuel, and water. Disruption of these arrangements, whether by war or by civil conflicts such as strikes, could bring any one of these metropolises to its knees in a matter of a few days.

Some of the many urgent problems faced by these metropolitan complexes relate to the mere facts of size and density; others arise because the established institutions of service and control have been unable to cope with fast-paced growth. Whatever the source of difficulty, a sense of crisis since the end of World War II has brought about a spectacular increase in the amount of analytical talent and planning skill applied to urban problems. Along with this self-examination has come a clear understanding that solutions must be oriented not merely to present circumstances, but to those of the future. Time horizons vary with the particular problem under study, but a review of the literature reveals few instances in which it has

*A Standard Metropolitan Statistical Area (SMSA) consists of a central city of 50,000 inhabitants or more, the county or counties in which that city is located, and all contiguous counties which are "essentially metropolitan in character and are socially and economically integrated with the central city" in terms of population density, labor-force structure, and inter-county commuting flows. The Honolulu SMSA, which was 53rd in size and just over the half-million mark, was not included in this study because of its unique geographical and ethnic circumstances.

seemed profitable to look ahead more than 40 years, and 25 years seems to be adequate for most purposes.*

Forecasts of metropolitan populations are integral to local planning decisions as well as to a number of issues of national policy. The aim of the present study has been to develop a sufficiently detailed image of future metropolitan populations to be useful to local agencies, while maintaining a national perspective on metropolitan growth.

The initial stimulus to these projections of metropolitan populations came from an analysis of urban transportation problems for the Ford Foundation; it has since become apparent that the projections will be helpful to other RAND studies concerned with future military postures, civil defense measures, assessment of possible war damage, and post-attack recovery problems. Moreover, local planning agencies evince considerable interest in the detailed quinquennial projections for their own SMSA's.

There have been many population projections for the United States as a whole; currently, the most widely used are the component projections published by the Bureau of the Census in 1962. The Bureau has also published (1957) projections for each of the 50 states, in which projected totals from an earlier national projection were allocated among the states on the basis of comparative state and national growth-trends of the past few decades. While there have been many rather casual estimates of the future growth of U.S. metropolitan population as an aggregate, the only national series which deals seriously with specific metropolitan areas was prepared in 1959 by Jerome Pickard; Pickard's projections are for territorial units ("major metropolitan areas") of his own creation, generally smaller than SMSA's, and his technique is similar to that used in the Census Bureau's state projections.

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*Many planning decisions call for the commitment of resources to major capital investments such as schools and freeways. An appropriate time-horizon for these decisions is the time required to amortize the investment.

**U.S. Bureau of the Census, Illustrative Projections of the Population, by States, 1960, 1965, and 1970, Current Population Reports,

Forecasting population growth is a popular sport, and forecasts or projections have been made by local agencies in virtually all of the SMSA's covered by the present report. These vary so much in technique, assumptions, time horizons, and in the precise areas covered that it seemed worthwhile to re-work the basic data from a national perspective, applying a standard technique and generating projections in a standard format. Obviously projections of this sort, made on a mass-production basis, cannot take account of many peculiar and undocumented features of individual SMSA's. On the other hand, there is an advantage to the quasi-global approach in that projections for any one place may be constrained by the requirement of consistency with projections for other places. (The point is particularly applicable to estimates of net migration, and migratory flows account for most of the current differences in SMSA growth rates.) Moreover, because of the scale of this project, I have been able to use a fairly elaborate method of component projections programmed for a high-speed computer. Once the algorithm is programmed and the basic demographic data have been keypunched, it is a simple matter to explore the full implications of alternative assumptions concerning vital rates and migratory movements.

Series P-25, No. 160, August 1957; and Illustrative Projections of the Population of the United States, by Age and Sex, 1960 to 1980, Current Population Reports, Series P-25, No. 187, November 1958; the latter is supplemented by "interim revised projections" (Series P-25, No. 241, January 1962; and No. 251, July 1962) which incorporate bench-mark data from the 1960 Census of Population. The Census Bureau is currently working on a new series of national projections to be released in mid-1964; advance figures from this series are available in Projection of the Population of the United States by Age and Sex to 1985, Current Population Reports, Series P-25, No. 279, February 1964. Pickard's projections are published under the title, Metropolitanization of the United States, Research Monograph 2, Urban Land Institute, Washington, D. C., 1959. See also Water Resources Activities in the United States, "Population Projections and Economic Assumptions," Committee Print No. 5, Select Committee on National Water Resources, United States Senate, 1960; and Projections to the Years 1976 and 2000: Economic Growth, Population, Labor Force and Leisure, and Transportation, Study Report 23, Outdoor Recreation Resources Review Commission, U.S. Government Printing Office, Washington, D. C., 1962.

I have designated these as trial projections because the underlying assumptions are subject to revision in the light of their issue. Specifically, further refinements in migration assumptions are contemplated, based on 1) nation-wide accounting checks on assumed migration flows, 2) an analysis of the characteristics of migrants as reported in the 1960 Census, and 3) projections of economic activity for individual SMSA's, to be supplied by the National Planning Association. A final projection series, incorporating new migration assumptions (and perhaps altered vital rates) will appear in due course.

Despite the tentative nature of these projections, it seems useful to publish a report exploring their implications. This is especially true since detailed tables for individual SMSA's have been distributed to local planning agencies for review and comment, and this more general report will help these agencies to put the local projections into national perspective.

As noted, these are projections of SMSA populations; however, it may be well to distinguish between the SMSA as a territorial unit and as a functional aggregate of population. From time to time, the boundaries of individual SMSA's are changed as adjacent counties qualify for inclusion; a few SMSA's have been subdivided in recognition of emergent multiple nodality.* Undoubtedly, further changes will be made in future years.

The bases from which these projections were made consist of the populations included within the boundaries of each SMSA, as defined at the time of the 1960 Census, but I do not imply that the projected populations will necessarily be located entirely within those same boundaries. Rather I mean to suggest that the projected populations would be functional members of their metropolitan communities in the same sense that the 1960 populations were.

The projection of the territorial extent of future SMSA's requires more data than emerge from population projections alone. My colleagues

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*E.g., in 1959 the New York-Northeastern New Jersey SMSA was subdivided into four parts, the conurbation being redesignated as a Standard Consolidated Area.

at RAND have made an important beginning by collecting time-series on land use in central cities of most of the SMSA's included in this report.* I have added a little to these series, and it is on my agenda to make use of them, in combination with population projections, in a study of the future spatial structure of the nation's largest SMSA's.

Two sets of trial projections, designated RAND Series I and II, are summarized for individual SMSA's in Table 1 of this report. These series differ only with respect to migration inputs; the first assumes zero net migration throughout the projection period, while the second assumes that the 1950-1960 migration pattern prevails. The table of projections is introduced in Section II by a discussion of the components of population change and their relative importance at the metropolitan level. RAND Series II projections are then compared to forecasts and projections recently prepared by local planning agencies.

The following sections (III through VI) report on various implications of the RAND Series II projections in the light of historical experience. Projected metropolitan growth is compared with projected national growth, regional differences in projected metropolitan growth are examined, and the probable ethnic composition and age structure of future metropolitan populations are described. In Section VII, the principal findings are reviewed, and plans for a third series of projections are discussed.

To the serious user of population projections, knowledge of the underlying methods, assumptions, and historical data are essential. This information is fully reported in the Appendix.

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*See John H. Niedercorn and Edward F. R. Hearle, Recent Land-Use Trends in Forty-Eight Large American Cities, The RAND Corporation, RM-3664-FF, June 1963. For a most interesting analysis of the territorial and demographic growth of a metropolitan area, see Kingsley Davis and Eleanor Langlois, Future Demographic Growth of the San Francisco Bay Area, Institute of Governmental Studies, University of California at Berkeley, 1963.

II. PROJECTING METROPOLITAN POPULATIONS

Demographic forecasting is an occupation in ill repute, even among those who recognize the value of foresight. One reason is that forecasters often disagree; another is that they have usually been proven wrong by subsequent events.* The consequence is that demographers have become increasingly cautious, even though their understanding of demographic processes has increased. Today it is usual to distinguish between forecasts and projections. Whereas a forecast is a prediction that certain events will come to pass, a projection takes the form of an "if....then" proposition; to quote one foreword:

> Some care must be exercised in the use and interpretation of these estimates. It is to be emphasized that they are not predictions of future population size, nor are they to be assumed to indicate the probable sex and age structure. They are, strictly speaking, merely statements of what the size and the sex, age, color and nativity composition of the population would be at specified future times if birth rates, death rates, and immigration were to follow certain specified trends.**

The estimates of future SMSA populations presented in this report are most emphatically projections in the sense of the quotation above. At the same time, the projections have been made with enough attention to detail--to the disparate composition of the present populations of these SMSA's and to the trends in components of change--to allow plausibility of the outcomes to be argued, pro or con, on fairly substantial grounds.

This study divides the 1960 population of each SMSA into five-year age groups, by sex and color (white/non-white), a total of 60 components.

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*An excellent critical review of national population forecasts (beginning with those of B. Franklin in 1751) is offered by Harold F. Dorn, "Pitfalls in Population Forecasts and Projections," Journal of the American Statistical Association, Vol. 45, September 1950, pp. 311-334.

**Warren S. Thompson and Pascal K. Whelpton, Estimates of Future Population of the United States, 1940-2000, National Resources Planning Board, Washington, D.C., 1943, pp. 3-4.

For the projections, each of these components is aged over time. Periodic deductions are made for mortality as indicated by the extension of historical trends in death rates, specific for each component. Age-specific birth rates, by color, are also projected into the future for each SMSA; the projected rates are applied to females of childbearing age, generating a schedule of quinquennial births which is periodically added into the total. Finally, an assumed net number of migrants are added to or subtracted from (as appropriate) each of the 60 components. The results of all these changes are summarized for each age/sex/color component at every fifth year, 1960-1985.

In the Appendix to this report, the assumptions which determine the outcomes of the projections are clearly stated in terms of detailed vital rates and migration flows. Some of these assumptions are relatively safe as forecasts. For example, national death rates specific to age, sex, and color, show only minor deviations around trends dating from 1900; the only major departures (associated with the influenza epidemic of 1918) were quite brief.

Birth rates are less predictable. Age-standardized fertility indices for the nation reached an all-time low during the Great Depression of the 1930's; during the 1940's and early 1950's, fertility rose steadily to a peak in 1957 about twice as high as the depression minimum. Since 1957, birth rates have turned down, and studies of cohort fertility and surveys of anticipated family size indicate a continued mild decline during the rest of the 1960's.* The timing of births, and to a lesser extent the size of the completed family, clearly fluctuates in response to changing economic conditions and social disturbances. Obviously, I have no advance notice of such events; I am willing, however, to suppose that projections which do not allow for catastrophe are useful in making plans which also are typically premised on peace and economic stability.

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*See, for instance, Pascal K. Whelpton, "Why Did the United States Crude Birth Rate Decline During 1957-62?", Population Index, Vol. 29, No. 2, April 1963, pp. 120-124.

The reader is referred to the Appendix for the fertility rates used in these projections; in general, this study assumes a continuation of the 1960 level of national fertility, a trend toward earlier completion of families, and continuation of existing geographic differentials in birth rates.* It is worth noting that decomposition of the female population by age and color makes it possible to take explicit account of changes in age distribution which will affect the number of births nearly as radically as have most short-run fluctuations in age-specific birth rates.

For national population projections, the strategic variables are birth rates; for local ones, internal migration assumes an overriding importance. Each year since 1947, according to the Bureau of the Census, about 20 per cent of the population of the United States has moved. From a series of sample surveys conducted by the Bureau, it can be calculated that about half of the population over 20 years of age has moved at least once during the preceding four years, and 70 per cent has moved at least once during the preceding decade. Most of the moves are purely local, to a new address in the same county; but in the year ending 1 March 1960, 11.2 million persons moved to a different county, and 5.5 million moved to a different state; about .9 million persons entered this country from abroad.**

There are substantial differences in birth rates among the SMSA's included in this study, and smaller differences in death rates; but most of the variation in SMSA growth rates can be traced to internal migration. Of the nation's two largest SMSA's the net increase attributable to migration during the decade 1950-1960 was one per cent of the 1950 population for New York and 36 per cent for Los Angeles. A number of SMSA's suffered net out-migration, in one case (Jersey

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*These assumptions are most comparable to the Series II fertility projections devised by the Bureau of the Census for their national and state population projections. (See citations on p. 3, above.)

**Including both immigrants of foreign extraction and returning citizens of the United States.

City) amounting to 15 per cent of its 1950 population; others received as in-migrants nearly the equivalent of their entire 1950 populations (e.g., 93 per cent for San Jose, California).

While there is some consistency over the last several decades in the direction of the major migratory flows between geographic divisions of the nation, the magnitude of the stream of migrants reaching any one SMSA varies considerably over time. A comparison of the 1940-1950 and 1950-1960 net migrations to the SMSA's included in this study (see Appendix, Table 16) provides abundant evidence that this component of population change is not predictable on the basis of simple historical trend.

I have therefore prepared alternative projections, which differ only with respect to the assumed flows of migrants. Series I projections assume zero net migration during the entire period covered by the projections, whereas Series II projections assume a quinquennial flow of half the magnitude which has been estimated for each SMSA, 1950-1960. This is the only respect in which the two series differ. The projected population of each SMSA under these alternative assumptions is shown in Table 1 at the end of this section.

In the present state-of-the-art, the best basis for projecting migration to a local area is a careful study of the prospects of its economy and the extent to which future labor-force requirements can be satisfied by the resident population. Such calculations, however, are essentially iterative. They require an initial assumption as to migration flows, an assumption which is later revised in the light of its implications for employment shortages or surpluses.* It is in this context that RAND Series I and II projections are most useful to local agencies.

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*A good description of the technique of such iterative projections will be found in Benjamin Chinitz, "Pittsburgh Studies Its Economy," Pennsylvania Business Survey, June 1961. Economic projections for individual SMSA's, soon to be published by the National Planning Association, will use my Series I and II population projections in this way; in the light of their findings, I plan to adjust my migration assumptions for Series III projections.

In national perspective, however, the Series II projections, for all their arbitrary assumptions, have greater significance. While the projections may turn out seriously wrong as forecasts for a particular SMSA because of the redirection of migration, the growth of the aggregate SMSA population located in regional subdivisions of the United States will be less affected, and the over-all national pattern of SMSA growth only minimally altered by such events.

Although the summaries presented in Table 1 include Series I projections (zero net migration), the discussion in the remainder of the report centers around Series II projections (1950-1960 net migration). This emphasis reflects my feeling that the second series is more interesting than the first, a sentiment apparently shared by local agencies with which I am in contact.

The results of RAND's Series II projections have been compared with projections independently prepared by local agencies for each SMSA from which such data could be obtained, with results as shown in Table 2. These local projections and forecasts were made by a variety of methods, including the simple extrapolation of historical growth curves or of ratios of local to national population (using the Census Bureau's national projection series), and component projections based on recent vital rates and migration trends. In general, methods were less elaborate than those used by RAND--but not necessarily less reliable in the forecasting sense. With one or two exceptions, the local projections were made after the 1960 Census of Population reports were available, and the first entry in the table for each "local" projection is the enumerated population as reported by the Census for 1 April 1960. The first entry for each RAND projection, however, is the "projected" population for 1 July 1960, the mid-year date favored by demographic convention. The RAND quinquennial projections in subsequent columns also refer to 1 July of the year indicated; local projections are given for each quinquennium for which they were available, but most do not refer to a precise date within the year.

Local forecasts or projections to 1980 are available for 34 of

the 52 SMSA's covered by this report.* In 25 of these cases, RAND Series II projections for 1980 are within ten per cent of the local projections for the same year. The nine cases of greater disparity are listed below:

SMSA	RAND Series II Projection for 1980 as Per Cent of Local Projection
Birmingham	86.6
Chicago	112.6
Dayton	117.4
Gary-Hammond-East Chicago	115.3
Los Angeles	115.5 to 113.1
Milwaukee	83.4
New Orleans	124.3 to 107.0
San Diego	123.5
Youngstown	116.0

In the cases of Chicago and Gary-Hammond-East Chicago, the technique of the local projections shown was essentially the same as RAND's, as were the assumed migration flows. The differences in outcome are ascribable to a higher mortality assumption and a much lower fertility assumption.**

*These local projections were obtained by mail survey in the latter part of 1963, from central-city, metropolitan, and state planning agencies. Respondents were requested to supply "the best local population forecasts known to you," not including forecasts published prior to 1960, for both the central city and the SMSA. Replies were received from agencies in 49 of the 52 SMSA's from which they were solicited, but in 15 cases the respondents were unable to supply population forecasts or projections for the SMSA. (In some of these cases, central-city or county forecasts were furnished; these are not included in Table 2.) To avoid placing an undue burden on respondents, we did not request background data on the projections, other than the identification of the agency responsible, and the date published. Thus, while some agencies supplied documents which describe the methods and assumptions used, we cannot in most cases identify the reasons for correspondence or discrepancy between the local projection and the RAND projection.

**The U.S. life table for 1959 was applied to the entire projection period, and U.S. age-specific birth rates for 1950 were assumed to apply to the Chicago Consolidated Area in 1960, with a projected decline in these rates of ten per cent per decade thereafter. (The actual age-specific birth rates in 1960 for the key age groups, 20-24 years and 25-29 years, were 25 to 30 per cent higher than those assumed.) Cf. Donald J. Bogue and D. P. Dandekar, Population Trends and Prospects for the Chicago-Northwestern Indiana Consolidated Metropolitan Area: 1960 to 1990, Population Research and Training Center, University of Chicago, 1962, pp. 44-48.

For Los Angeles-Long Beach and San Diego, the projections prepared by the California Department of Finance assume a return by 1980 to the age-specific birth rates of 1943, i.e., a drop of 20 to 30 per cent from 1960. California life tables were used, and no decline in mortality was anticipated. For San Diego at least, a decline in the volume of in-migration was assumed.*

New Orleans should probably not be included in this list of discrepant cases, since only one of four alternative projections prepared by the City Planning Commission falls outside the range of substantial agreement (± ten per cent) with RAND Series II projections. Background data are not available for the projections reported for the remaining four SMSA's on the list.

It is not my intention to suggest that the RAND projections are either better or worse than those prepared by local agencies. Where the differences between RAND and local projections are small, it is a fair inference that the local agencies have used, explicitly or implicitly, assumptions close to those employed in RAND Series II. This coincidence does not, of course, prove that the assumptions are the most appropriate ones in the forecasting sense.

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*These statements are based on my conversation with Mrs. Isabel Hambright of the State Department of Finance, Financial and Population Research Section, rather than on published data. Errors are thus my responsibility.

Table 1

QUINQUENNIAL PROJECTIONS OF THE POPULATIONS OF 52 LARGE SMSA'S, 1960-1985

SMSA NAME	RAND PROJECTION SERIES	1960	1965	1970	1975	1980	1985
AKRON	I	515378	550991	590891	639529	694938	753346
	II	510075	567679	626984	697459	778872	861852
ALBANY	I	659158	691718	727833	770924	820306	873249
	II	659033	689515	725873	771482	824821	882567
ATLANTA	I	1021492	1105330	1191139	1285543	1389377	1498879
	II	1024519	1176879	1344872	1531766	1735311	1951732
BALTIMORE	I	1733433	1860231	1995962	2151958	2328869	2520501
	II	1735666	1914198	2115761	2349347	2614442	2905963
BIRMINGHAM	I	637068	682071	732773	791789	857420	926585
	II	636443	667774	703096	744971	792204	841938
BOSTON	I	3117853	3285611	3459868	3657261	3882416	4128940
	II	3115280	3229257	3357814	3517946	3710949	3928353
BUFFALO	I	1311358	1396165	1485873	1592275	1716714	1850668
	II	1312422	1422337	1544779	1689888	1858445	2042409
CHICAGO	I	6243180	6665214	7094121	7590989	8178569	8833019
	II	6249612	6832881	7493897	8275278	9187747	10211840
CINCINNATI	I	1075623	1153564	1235312	1330305	1442088	1567347
	II	1076066	1166230	1268527	1390083	1531804	1690091
CLEVELAND	I	1802278	1909735	2021989	2155401	2309448	2472024
	II	1804690	1970085	2158893	2381701	2633880	2903710
COLUMBUS	I	685917	743097	799758	861545	932898	1012073
	II	687888	790673	906344	1037311	1184335	1345404
DALLAS	I	1088165	1177469	1269680	1373065	1489566	1614907
	II	1092416	1276568	1480069	1707601	1958573	2229736
DAYTON	I	697441	752727	811606	880056	957131	1038134
	II	699122	793308	900120	1022810	1158753	1303816
DENVER	I	933176	1007274	1085184	1175307	1277875	1387133
	II	937874	1115816	1313421	1536249	1782940	2048738
DETROIT	I	3776938	4057644	4354074	4708043	5121552	5560867
	II	3778979	4114188	4489397	4939276	5461161	6021500
FORT WORTH	I	575454	619872	667554	722424	783374	847075
	II	577574	669408	772176	887853	1013722	1146825
GARY	I	576289	630807	689849	759569	840442	928084
	II	577974	670525	775341	897707	1037879	1192020
HARTFORD	I	691786	733755	776666	827031	885777	948587
	II	693242	768097	850056	943667	1049056	1162323
HOUSTON	I	1249046	1363762	1482961	1619898	1774719	1938624
	II	1254315	1487730	1745915	2037572	2360683	2708264

Table 1 -- continued

SMSA NAME	RAND PROJECTION SERIES	1960	1965	1970	1975	1980	1985
INDIANAPOLIS	I	700519	758420	819815	891570	975798	1070379
	II	701475	782624	874813	982275	1104936	1241185
JERSEY CITY	I	612283	640594	667491	696240	728710	765349
	II	609732	585496	561303	539312	519614	502526
KANSAS CITY	I	1043474	1120553	1202130	1299390	1414750	1543246
	II	1045482	1169555	1310054	1474362	1662440	1870358
LOS ANGELES	I	6764883	7189952	7637906	8158797	8748648	9371596
	II	6804816	8108845	9541722	11133688	12872204	14727526
LOUISVILLE	I	728075	786726	851308	927895	1015951	1111641
	II	728884	806996	896584	1001868	1120965	1250398
MEMPHIS	I	629668	683013	742631	813740	896248	987096
	II	630581	705002	791308	893304	1009552	1137066
MIAMI	I	937334	979145	1022338	1074448	1135081	1199813
	II	945941	1172072	1411115	1668472	1942794	2230562
MILWAUKEE	I	1199075	1290760	1383722	1490501	1616939	1759393
	II	1200887	1334937	1483803	1657223	1858688	2085165
MINNEAPOLIS	I	1488563	1616509	1748947	1899885	2077604	2277065
	II	1490783	1670938	1876267	2116262	2393205	2701266
NEW ORLEANS	I	872234	947005	1028189	1123310	1233804	1357251
	II	873336	974284	1089866	1225472	1380331	1552167
NEW YORK	I	10719709	11162837	11563571	11994211	12474422	12986589
	II	10722579	11256941	11828726	12486187	13226254	14028640
NEWARK	I	1693797	1774379	1854550	1947134	2052278	2162807
	II	1694993	1805066	1925392	2065917	2225816	2398907
NORFOLK	I	581375	638080	698154	767826	848583	937264
	II	581808	651592	732771	828021	935979	1054289
OKLAHOMA CITY	I	513857	554203	596766	644162	697016	754376
	II	514834	577558	647774	726704	813595	907865
PATERSON	I	1189891	1244763	1300441	1367972	1443787	1518235
	II	1194463	1348796	1513396	1696988	1896107	2101520
PHILADELPHIA	I	4356032	4605595	4862595	5160175	5503508	5873324
	II	4360249	4706491	5085330	5525547	6030088	6580590
PHOENIX	I	666558	729246	800700	884276	977715	1078944
	II	672386	860436	1068594	1301152	1556612	1833327
PITTSBURGH	I	2411920	2536759	2670194	2827135	3003021	3182498
	II	2409377	2480108	2557362	2656893	2775804	2899454
PORTLAND	I	823835	864988	916632	980899	1051727	1124770
	II	824613	882532	952687	1037418	1131453	1230961

Table 1 -- continued

SMSA NAME	RAND PROJECTION SERIES	1960	1965	1970	1975	1980	1985
PROVIDENCE	I	720207	754472	792105	836922	887850	941888
	II	719290	731635	746468	768187	796028	826837
ROCHESTER	I	583062	619851	653690	694989	743809	796302
	II	588887	639641	697603	766876	846633	933306
SACRAMENTO	I	505083	550760	600247	658285	724040	794994
	II	509013	641270	789139	955812	1140357	1341409
SAN ANTONIO	I	690650	761718	840123	931109	1034610	1148125
	II	691787	789581	901451	1030658	1174096	1328602
SAN BERNARDINO	I	812718	873472	944925	1031315	1130077	1237309
	II	819016	1015167	1232756	1476483	1744625	2034254
SAN DIEGO	I	1037537	1126708	1221598	1331332	1457845	1598164
	II	1045772	1316381	1616283	1949126	2313263	2708226
SAN FRANCISCO	I	2791615	2950023	3115431	3305986	3519424	3745975
	II	2796859	3078860	3398488	3762167	4159450	4582955
SAN JOSE	I	645364	705215	768136	840429	922403	1009855
	II	652192	860429	1089672	1345217	1627826	1934409
SEATTLE	I	1110710	1180789	1259602	1353621	1459746	1571078
	II	1113926	1256063	1419606	1603772	1816149	2039039
ST LOUIS	I	2067518	2211733	2365248	2547884	2764376	3004756
	II	2068919	2248378	2452986	2699015	2988103	3310753
SYRACUSE	I	565815	606111	649500	699911	757986	821428
	II	566409	620127	681077	752841	835209	925550
TAMPA	I	773275	789761	816679	856947	907885	966817
	II	780922	957271	1142089	1340470	1552493	1777573
WASHINGTON,D.C.	I	2010528	2175008	2337772	2518055	2720689	2939053
	II	2015693	2301696	2619885	2976903	3373422	3796484
YOUNGSTOWN	I	510691	543421	579440	623497	674386	727324
	II	511232	556206	606748	667218	736586	810373

SOURCE: The RAND Corporation.

NOTE: These are projected midyear populations for each SMSA as defined in 1960. Figures shown for 1960 are thus three-month projections from the Census enumeration of April 1. See text for explanation of Series I and II assumptions.

Table 2

COMPARISON OF POPULATION PROJECTIONS FOR 52 LARGE SMSA'S: RAND SERIES II AND LOCAL AGENCIES

	POPULATION PROJECTION OR FORECAST					
	1960	1965	1970	1975	1980	1985
AKRON						
RAND SERIES II	516075	567679	626984	697459	776872	861852
NO LOCAL FORECAST	513569					
ALBANY						
RAND SERIES II	659033	689515	725873	771482	824521	882567
CANDEUB,FLEISSIG	657503		753222		876018	
ATLANTA						
RAND SERIES II	1024519	1176879	1344872	1531766	1735311	1951732
METRO PLAN COMMISS	1017188	1182600	1361700	1572900	1817700	2086000
BALTIMORE						
RAND SERIES II	1735666	1914198	2115761	2349347	2614442	2905963
STATE PLAN DEPT-LOW	1727023		2028300		2380000	
STATE PLAN DEPT-HIGH	1727023		2085000		2490000	
BIRMINGHAM						
RAND SERIES II	636443	667774	703096	744991	792204	841938
PLAN ZONE DEPT	634864		759932		914958	
BOSTON						
RAND SERIES II	3115280	3229257	3357814	3517946	3710949	3928353
NO LOCAL FORECAST	3109158					
BUFFALO						
RAND SERIES II	1312422	1422337	1544779	1689888	1858445	2042409
UPSTATE TRANSP STUDY	1306957	1419016	1530057	1648053	1779510	1927178
CHICAGO						
RAND SERIES II	6249612	6832881	7493897	8275278	9187747	10211840
U CHI POP RESRCH CTR	6220913	6652000	7082000		8161000	
CINCINNATI						
RAND SERIES II	1076066	1166230	1268527	1390083	1531804	169[illegible]
BUREAU GOVT RESEARCH	1071624		1300000		1588000	
CLEVELAND						
RAND SERIES II	1804690	1970085	2158893	2381701	2633880	2903710
NO LOCAL FORECAST	1796595					
COLUMBUS						
RAND SERIES II	687888	790673	906344	1037311	1184335	1345404
NO LOCAL FORECAST	682962					
DALLAS						
RAND SERIES II	1092416	1276568	1480069	1707601	1958573	2229736
SMU DEPT SOCIOLOGY	1083601	1250000	1470000	1730000	1960000	
DAYTON						
RAND SERIES II	699122	793308	900120	1022810	1158753	1303816
MORTON HOFFMAN CO.	694623		840800		987000	
DENVER[8]						
RAND SERIES II	937874	1115816	1313421	1536249	1782940	2048738
DENV PLAN OFF.& CNTY	870000		1245000		1600000	
DPO-ADJ TO SMSA	929383		1329947		1708981	
DETROIT						
RAND SERIES II	3778979	4114188	4489397	4939276	5461161	6021500
METRO PLAN COMMISS	3762360		4414500		5355000	
CITY PLAN COMMISSION	3762360	4110000	4460000	4810000	5160000	

Table 2 -- continued

	POPULATION PROJECTION OR FORECAST					
	1960	1965	1970	1975	1980	1985
FORT WORTH						
RAND SERIES II	577574	669408	772176	887853	1013722	1146825
NO LOCAL FORECAST	573215					
GARY						
RAND SERIES II	577974	670525	775341	897707	1037879	1192020
U CHI POP RESRCH CTR	573540	643000	712000		900000	
HARTFORD						
RAND SERIES II	693242	768097	850056	943667	1049056	1162323
NO LOCAL FORECAST	689555					
HOLSTON						
RAND SERIES II	1254315	1487730	1745915	2037572	2360683	2708264
CITY PLAN DEPT	1243158	1560000	1860000	2160000	2480000	
INDIANAPOLIS						
RAND SERIES II	701475	782624	874813	982275	1104936	1241185
METRO PLAN DEPT	697567	803500	916000	1004000	1091000	
JERSEY CITY						
RAND SERIES II	609732	585496	561303	539312	519614	502526
REG PLAN ASSOC	610734		575000	550000	540000	
KANSAS CITY						
RAND SERIES II	1045482	1169555	1310054	1474362	1662440	1870358
NO LOCAL FORECAST	1039493					
LOS ANGELES						
RAND SERIES II	6804816	8108845	9541722	11133688	12872204	14727526
CHAMBER OF COMMERCE	6742696		8931000		11144000	
DEPT OF FINANCE 1963	6791400	7982200	9104600	10246500	11385900	
LOUISVILLE						
RAND SERIES II	728884	806996	896584	1001868	1120965	1250398
NO LOCAL FORECAST	725139					
MEMPHIS						
RAND SERIES II	630581	705002	791308	893304	1009552	1137066
SHELBY CNTY PLAN COM	627019	705000	793000	891000	1002000	1126000
MIAMI						
RAND SERIES II	945941	1172072	1411115	1668472	1942794	2230562
DADE CNTY PLAN DEPT	935047	1154000	1467000	1757000	2079000	2433000
MILWAUKEE						
RAND SERIES II	1200887	1334937	1483803	1657223	1858688	2085165
SE WIS REG PLAN COMM	1194290		1566182		2227807	
MINNEAPOLIS						
RAND SERIES II	1490783	1670938	1876267	2116262	2393205	2701266
NO LOCAL FORECAST	1482030					
NEWARK						
RAND SERIES II	1694993	1805066	1925392	2065917	2225816	2398907
NO LOCAL FORECAST	1689420					
NEW ORLEANS[b]						
RAND SERIES II	873336	974284	1089866	1225472	1380331	1552167
CITY PLAN COMMISS I	868480		989500		1110600	
CITY PLAN COMMISS IV	868480		1071600		1290000	

Table 2 -- continued

	POPULATION PROJECTION OR FORECAST					
	1960	1965	1970	1975	1980	1985
NEW YORK						
RAND SERIES II	10722579	11256941	11828726	12486187	13226254	14028640
REG PLAN ASSOC	10694833	11120000	11550000	11980000	12399000	12825000
NORFOLK						
RAND SERIES II	581808	651592	732771	828021	935979	1054289
NO LOCAL FORECAST	578507					
OKLAHOMA CITY						
RAND SERIES II	514034	577558	647774	726704	813595	907865
CITY PLAN COMMISSION	511033	585000	674000		879000	1100000
PATERSON						
RAND SERIES II	1194463	1348796	1513396	1696988	1896107	2101520
NO LOCAL FORECAST	1186873					
PHILADELPHIA						
RAND SERIES II	4360249	4706491	5085330	5525547	6030088	6580590
CITY PLAN COMMISSION	4342897		4984000		5821000	
PHOENIX						
RAND SERIES II	672386	860436	1068594	1301152	1556612	1833327
NO LOCAL FORECAST	663510					
PITTSBURGH						
RAND SERIES II	2409377	2480108	2557362	2656893	2775804	2899454
REG PLAN ASSOC	2405435	2482253	2560237	2655087	2771906	2883578
PORTLAND						
RAND SERIES II	824613	882532	952687	1037418	1131453	1230961
METRO PLAN COMMISS	821897	899000	983000	1079000	1190000	
PROVIDENCE						
RAND SERIES II	719290	731635	744468	758187	796028	826837
NO LOCAL FORECAST	718543					
ROCHESTER						
RAND SERIES II	588887	639661	697603	766876	846633	933306
NO LOCAL FORECAST	586387					
SACRAMENTO						
RAND SERIES II	509013	641270	789139	955812	1140357	1341409
COUNTY PLAN DEPT	502778		830000		1260000	
DEPT OF FINANCE 1963	510300	644900	773200	915500	1073000	
SAN ANTONIO						
RAND SERIES II	691787	789581	901451	1030658	1174096	1328602
NO LOCAL FORECAST	687151					
SAN BERNARDINO						
RAND SERIES II	819016	1015167	1232756	1476483	1744625	2034254
DEPT OF FINANCE 1963	820700	1024500	1228900	1451000	1691400	
SAN DIEGO						
RAND SERIES II	1045772	1316381	1616283	1949126	2313263	2708226
DEPT OF FINANCE 1963	1049000	1252700	1407700	1593000	1800100	
SAN FRANCISCO						
RAND SERIES II	2796859	3078860	3398488	3762167	4159450	4582955
BAY AREA TRANSIT DIS	2783399		3476000		4250000	
DEPT OF FINANCE 1963	2802300	3175700	3571800	4000800	4467100	

Table 2 -- continued

	POPULATION PROJECTION OR FORECAST					
	1960	1965	1970	1975	1980	1985
SAN JOSE						
RAND SERIES II	652192	860429	1089672	1345217	1627826	1934409
COUNTY PLAN DEPT-LOW	642315	890000	1125000	1360000	1590000	1790000
COUNTY PLAN DEPT-HI	642315	900000	1170000	1440000	1710000	1960000
DEPT OF FINANCE 1963	658700	906100	1154300	1421100	1708000	
SEATTLE						
RAND SERIES II	1113926	1256063	1419606	1607772	1816149	2039039
CITY PLAN COMMISS	1107213	1267200	1438100	1636400	1846300	2086900
ST LOUIS						
RAND SERIES II	2068919	2248378	2452986	2699015	2988103	3310753
METRO PLAN COMMISS	2060103	2246500	2445800	2634900	2822100	
SYRACUSE						
RAND SERIES II	566409	620127	681077	752841	835209	925550
NO LOCAL FORECAST	563781					
TAMPA						
RAND SERIES II	780922	957271	1142089	1340470	1552493	1777573
NO LOCAL FORECAST	772453					
WASHINGTON, D.C.						
RAND SERIES II	2015693	2301696	2619885	2978903	3373422	3796484
NATL CAP TRANS AGENC	2001897		2579000		3200000	
YOUNGSTOWN						
RAND SERIES II	511232	556204	606748	667218	736586	810373
MORTON HOFFMAN CC	509006		562000		635000	

SOURCES: RAND Series II projections, The RAND Corporation; local projections were obtained by mail survey of planning agencies late in 1963.

NOTE: RAND Series II projections are for midyear, including 1960. Intra-year reference of local forecasts and projections varies (January 1, April 1, July 1, unspecified). For 1960, the "local" entry is actually the population enumerated by the Census on April 1.

[a]Population projections prepared by the Denver Planning Office for four of the five metropolitan counties were adjusted by the author to include the fifth.

[b]The New Orleans City Planning Commission prepared four alternative projections. Those shown are the extremes.

III. THE NATIONAL CONTEXT OF METROPOLITAN GROWTH

The population of the United States is becoming increasingly urban, in all reasonable senses of that vague term. Using the Census Bureau's pre-1950 definition,* the proportion of the nation's people living in urban places grew from 40 per cent in 1900 to 63 per cent in 1960. Under the more liberal definition used recently, almost 70 per cent of the 1960 population lived in urban places.

This process of urbanization is the product of two distinct trends. One is the aggregate growth of the U.S. population, which tends to increase the densities of local settlement, causing formerly "rural" places to be reclassified as "urban." The other is internal migration, which has favored the established foci of population with growth at the expense of the rural hinterlands.

While a village of 2,500 people is not exactly rural, neither is it urban in the sense that New York or Los Angeles is urban. In recent years, the Census Bureau has distinguished 213 major conurbations of the nation as Urbanized Areas, each composed of a central city of 50,000 or more, plus a fringe of contiguous minor civil divisions and enumeration districts which meet a general standard of urban density. In 1960 these areas contained 54 per cent of the U.S. population, and 76 per cent of the urban population. (For 1950, the corresponding figures were 46 and 72 per cent.)

While the Urbanized Areas thus include the populations of all large cities and their contiguous suburbs, they do not encompass a further fringe of towns and villages many of whose residents, in this age of the automobile, are functionally part of the urban complex either because they commute to jobs within the urbanized area or because they deal regularly with the central city as buyers or sellers of

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*Incorporated places of 2,500 or more inhabitants, plus other places treated as urban under "special rules." It would be pointless to recount the elaborate details of census definitions of "urban places," "Urbanized Areas," etc., in this brief review. These definitions may be found in the introduction to almost any published report of the 1960 Census of Population.

commodities and services or simply as frequent visitors. Consequently, the Federal statistical agencies have also established the Standard Metropolitan Statistical Area, which embraces the entire county in which the central city is located, and also includes all contiguous counties* which are "essentially metropolitan in character and are socially and economically integrated with the central city" in terms of population density, labor-force structure, and inter-county commuting flows. In 1960, 212 such areas were designated; they contained 113 million inhabitants, or 63 per cent of the population of the United States. Included in the SMSA population were 13 million officially rural inhabitants, but the other 100 million constituted almost 80 per cent of the entire urban population of the nation.

Reconstructing the history of SMSA growth is not easy. The present definition of "Standard Metropolitan Statistical Area" has been in effect only since 1959, although the concept has predecessors in the "Metropolitan Districts" delineated in the censuses of 1910-1940 and the "Standard Metropolitan Areas" of the 1950 census. Since the SMSA is a territorial unit meeting certain population criteria, its boundaries may change from census to census, and an urban center which meets SMSA criteria at one census will fall short of the standard at some earlier census.**

The simplest approach to historical reconstruction is to extend the 1960 boundaries of each SMSA into the past. On this basis, the 52 SMSA's covered by this report had an aggregate population of

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*For reasons which do not seem very compelling to this writer, the Census Bureau has made an exception to this rule for the New England states, where SMSA's are constructed of townships rather than counties. In this report, however, I have followed a well-blazed trail in using the nearest county-equivalent (State Economic Area) in place of the official New England SMSA.

**Donald J. Bogue has reconstructed the histories, 1900-1950, of the 162 Standard Metropolitan Areas (not SMSA's) delineated for the 1950 census, using 1950 boundaries for the entire period. See Population Growth in Standard Metropolitan Areas, 1900-1950, U.S. Housing and Home Finance Agency, Washington, D. C., 1953.

52 million in 1940, 64 million in 1950, and 81 million in 1960. These SMSA's held 39.4 per cent of the nation's people in 1940, and their share had increased to 44.9 per cent in 1960.

The last figures given, of course, indicate that these SMSA's have been growing more rapidly than the nation as a whole. The difference in pace is more clearly seen in terms of decade rates of growth, shown in Table 3. The table also shows the separate roles of births, deaths, and migration in achieving growth. Three points of particular importance are there revealed:

(1) The pace of growth, both for the nation and the SMSA's, was considerably higher in the 1950's than in the 1940's. Acceleration of growth was greater for the nation than for the SMSA's.

(2) The main reason for the higher rates of growth during the 1950's was an increase in crude birth rates; changes in crude death rates and in net migration rates were small by comparison. These observations apply both to the nation and to the group of SMSA's.

(3) Immigration played only a minor role in national population growth, whereas internal migration substantially contributed to SMSA growth.*

Although these historical comparisons cover only two decades, they are helpful in assessing the relationship between national and SMSA projections. The national population projections made by the Census Bureau in 1962 offer two alternative series, differing only with respect to assumed future levels of fertility. Both the fertility and mortality assumptions of Census Series II are very close in principle to those used in the SMSA projections prepared at RAND; and like RAND Series II, the Census projections assume that the 1950-1960 absolute levels of net migration will prevail throughout

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*Of course, some of the in-migrants to the SMSA's came directly from abroad. This might be a good place to explain the demographer's habit of using "immigration" and "emigration" to refer to movements across national boundaries, while describing movements across internal boundaries as "in-migration" and "out-migration." The difference between in-flows and out-flows is "net immigration" or "net in-migration"; a negative sign is used to indicate net outflows.

Table 3

COMPONENTS OF POPULATION CHANGE, UNITED STATES AND 52 LARGE SMSA'S, 1940-1960

Area	1940-1950		1950-1960	
	Thousands of Persons	Percentage of Base Year	Thousands of Persons	Percentage of Base Year
United States:[a]				
Net change in population	19,429	14.7	28,289	18.6
Births	32,064	24.2	40,963	27.0
Deaths	14,638	-11.1	15,653	-10.3
Net immigration	1,789	1.4	2,975	2.0
Errors of closure	214	0.2	5	--
52 SMSA's:[b]				
Net change in population	11,762	22.5	16,943	26.5
Births	12,078	23.1	17,447	27.3
Deaths	- 5,995	-11.5	- 6,911	-10.8
Net immigration	5,709	10.9	6,407	10.0
Errors of closure	- 30	- 0.1	--	--

[a]Adapted from U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 250, Table B.

[b]Taken from U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 7, and Donald J. Bogue, Components of Population Change, 1940-1950, Scripps Foundation and Population Research and Training Center, 1957, Table II. For SMSA's whose boundaries changed after 1950, I have adjusted births and deaths for 1940-1950. See also Table 4, footnote b.

the projection period. In other words, the assumptions underlying Census Series II and RAND Series II are close enough to allow their comparison.*

Table 4 shows the Census Series II projections of national population for 1970 and 1980, along with the RAND Series II projections of the aggregate populations of 52 large SMSA's. Data for 1940-1960 are included as background.

The Census projection yields a national growth rate for the 1960's which is identical (to one decimal place) with that of the 1950's,

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*See Current Population Reports, Series P-25, Nos. 187, 241, and 251, and Part IV of this report. Briefly, Census Series II assumes that the 1955 pattern of age-specific birth rates (for all women; no distinction is made between white and non-white fertility) will prevail over the entire projection period, but the quinquennial estimates of births thus derived are inflated by a factor of 1.029. The fertility parameters used in the RAND projections, if applied to the same national population, would yield very nearly the same results unless the racial composition of the population changed substantially during the projection period.

As indicated in Note 3, a new series of national projections is now being prepared by the Census Bureau. The principal innovation of this new series is the use of trends in cohort fertility rates for projecting the annual number of births. (The cohort fertility rate is a measure of completed family-size for a given generation of mothers.) Recent age-specific fertility rates, such as those described in the paragraph above, imply larger completed families than would be anticipated by extension of historical trends in completed family size; thus the new Census projections will in general allow fewer births over the next two decades than do the 1962 projections.

Census Series II mortality rates are averages of the high and low series prepared by T.N.E. Greville (Illustrative United States Population Projections, Actuarial Study No. 46, U.S. Social Security Administration, May 1957). Mortality projections used in the RAND projections are closest to Greville's low series. Again, the effects of the differing assumptions on the emergent estimates of total population would be slight.

The Census projections assume net immigration at the rate of 3.0 million persons per decade, distributed by age and sex as they were during the 1950's. (The estimated net immigration during that decade was 2.975 million persons.) RAND Series II projections assume total net migration to the 52 SMSA's in the amount of 6.461 million per decade, a figure derived from Census Survival estimat of net migration, 1950-1960, made by the present writer. Vital Events estimates by the Census Bureau for the same period yield a slightly smaller figure, 6.407 million.

Table 4

POPULATION OF THE UNITED STATES AND OF 52 LARGE SMSA'S, 1940-1960; AND SERIES II PROJECTIONS, 1960-1980

Area	1 April 1940	1 April 1950	1 April 1960	1 July 1960	1 July 1970	1 July 1980
United States[a]						
Numbers of persons, in thousands	132,288	151,718	180,007	180,670	214,222	259,584
Per cent change during preceding decade	--	14.7	18.6	--	18.6	21.2
52 SMSA's[b]						
Numbers of persons, in thousands	52,178	63,940	80,883	81,316	100,116	124,234
Per cent change during preceding decade	--	22.5	26.5	--	23.1	24.1

[a] Estimates of U.S. population include armed forces abroad; figures for 1 April 1940 to 1 April 1960 are taken from Current Population Reports, Series P-25, No. 250, and may not agree exactly with other Census sources. Figures for 1 July 1960 to 1 July 1980 are taken from Census Series II projections (CPR, Series P-25, Nos. 241 and 251).

[b] Estimates of SMSA populations include members of armed forces; SMSA boundaries for all years shown are as defined in 1960. Figures for 1 April 1940 are compiled from unpublished tabulations provided by the Census Bureau; they differ from those published in the 1960 Census of Population (Vol. I, Part A-1, Table 31) because of adjustments made to bring the treatment of student populations into conformity with those of later censuses. Figures for 1 April 1950 and 1 April 1960 are taken from the last source cited. Figures for 1 July 1960 to 1 July 1980 are taken from RAND projections, Series II.

rising again during the 1970's. Since this series assumes no change in age-specific fertility over the projection period, the projected differences in decade growth rates are almost entirely attributable to the changing age-distribution of adult females and the consequent variation in the numbers of children born each decade. Age-specific death rates are assumed to decline only slightly, although the crude annual death rate falls from 9.1 deaths per thousand persons in the early 1960's to 8.2 deaths per thousand in the late 1970's.*

Unlike the projected national growth rate, the corresponding rate for SMSA's drops back nearly to the level recorded for the 1940's before resuming its upward course. While the SMSA growth rate is affected by changing fertility and mortality in much the same way as the national growth rate, it is much more strongly affected by migration. The projection shown here (RAND Series II) assumes that the 1950-1960 level of net in-migration will apply also to the 1960's and 1970's. As the population base increases, the rate of in-migration diminishes, as shown in Table 5.

The national projections are based on a parallel migration assumption, but since net immigration is a very small component of growth to begin with, the declining rate has very little impact on over-all growth. Thus the projected convergence of SMSA and national growth rates is mostly attributable to assumed differences in migration flows, even though the assumptions are parallel in form.

While there is no particular reason to suppose the 1950-1960 migration flows, either to the nation or to the SMSA's, will be exactly duplicated in future decades, the assumption is justifiable as a first approximation. For the nation, zero net immigration is a plausible lower limit, and any substantial increase beyond three million per decade would require revision of the present statutes. The plausible range of variation for SMSA's is wider, but there is an a priori reason

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*Cf. Current Population Reports, Series P-25, No. 251, pp. 2-3. The drop in crude death rates is assisted by an increasingly favorable age distribution--i.e., one concentrated in the least susceptible age brackets.

Table 5

NET IMMIGRATION TO THE UNITED STATES AND NET IN-MIGRATION TO 52 SMSA'S, 1940-1960; AND SERIES II PROJECTIONS, 1960-1980

Area	1940-1950	1950-1960	1960-1970	1970-1980
United States				
Net immigration, in thousands[a]	1,789	2,975	3,000	3,000
Population at beginning of decade, in thousands[b]	132,288	151,718	180,670	214,222
Rate of net immigration (percentage of base-year population)	1.4	2.0	1.7	1.4
52 SMSA's				
Net in-migration, in thousands[c]	5,709	6,407	6,461	6,461
Population at beginning of decade, in thousands[b]	52,178	63,940	81,316	100,116
Rate of net in-migration (percentage of base-year population)	10.9	10.0	7.9	6.4

[a]Net immigration figures for 1940-1960 are taken from Current Population Reports, Series P-25, No. 250; projections from ibid., No. 251.

[b]Population series are taken from Table 4; see notes thereto.

[c]Net in-migration figures for 1940-1960 are taken from Current Population Reports, Series P-23, No. 7; projections, by The RAND Corporation.

to expect the rate to drop over time as the share of the nation's population held by this group of SMSA's increases, since the pool from which migrants can be drawn becomes relatively smaller. If the assumptions of RAND Series II projections hold, the 52 SMSA's will contain about 48 per cent of the nation's population in 1980, as compared to 39 per cent in 1940.

IV. REGIONAL PATTERNS OF SMSA GROWTH

The growth of the nation's large SMSA's has been notably uneven. During the 1940's, growth rates ranged from about zero (Jersey City) to 94 per cent (San Diego) for the decade. Growth rates of the 1950's have an even wider spread, from -6 per cent (Jersey City again) to 121 per cent (San Jose). For most SMSA's the pace of growth in the successive decades, while different, was at least of the same order of magnitude, but there are instances of drastic acceleration and deceleration. The population of Norfolk increased by 74 per cent in the decade of World War II, but only by 30 per cent in the postwar decade; San Jose grew by 62 per cent during the 1940's, but at twice that rate during the 1950's.

The relationship between size of SMSA and rate of growth is most easily illustrated by a comparison of the unweighted average of the growth rates of individual SMSA's with the weighted average of these same growth rates; in the latter calculation, each SMSA's growth rate is weighted in proportion to its population at the beginning of the decade. Since the eight largest SMSA's account for about half of the total population of those included in this report, the growth of these eight has considerable impact on the weighted average (or aggregate) rate of growth, but relatively little influence on the unweighted average. As the first lines of Tables 6 and 7 indicate, the unweighted average was larger than the weighted average in both decades, 1940-1950 and 1950-1960, indicating more rapid growth of the smaller SMSA's.

However, as two pre-1960 studies have shown,* apart from a general tendency for very large SMSA's to grow slowly, the relationship between size and rate of growth is weak and inconclusive. Even

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*Cf. Donald J. Bogue, Population Growth in Standard Metropolitan Areas, 1900-1950, U.S. Housing and Home Finance Agency, Washington, D. C., 1953, Part II; and Donald J. Bogue and Dorothy L. Harris, Comparative Population and Urban Research via Multiple Regression and Covariance Analysis, Scripps Foundation Studies in Population Distribution, No. 8, Oxford, Ohio, 1954, Ch. 2.

Table 6

POPULATION GROWTH IN 52 LARGE SMSA'S, 1940-1980; UNWEIGHTED AVERAGES FOR MAJOR GEOGRAPHIC DIVISIONS

Census Division and Region	Number of SMSA's Included	Percentage Change in Population During Decade			
		Intercensal[a]		RAND Series II Projections[b]	
		1940-1950	1950-1960	1960-1970	1970-1980
United States total	52	31.6	35.3	26.5	25.7
Northeast					
New England	3	12.0	13.8	11.4	13.5
Middle Atlantic	10	12.1	15.7	13.2	15.0
North Central					
East North Central	11	20.9	26.8	23.6	25.2
West North Central	3	18.5	25.4	23.3	25.4
South					
South Atlantic	6	46.6	51.2	34.1	30.4
East South Central	3	28.3	23.1	19.7	21.8
West South Central	6	41.0	40.0	31.6	30.2
West					
Mountain	2	57.3	79.0	49.4	40.8
Pacific	8	59.7	61.7	41.5	35.3

SOURCES: 1940-1960: U.S. Bureau of the Census, Current Population Reports, P-23, No. 7, November 1962, and unpublished tabulations. 1960-1980: The RAND Corporation

NOTE: Percentages of change were calculated separately for each SMSA. Figures shown are simple averages of these percentages for the SMSA s of each Census Region.

[a]Based on enumerations as of April 1 of Census year, for area included in the 1960 SMSA (or SEA in New England). Data for 1940 adjusted to conform to student place-of-residence rules used in 1950 and 1960.

[b]Projected midyear populations, beginning with July 1, 1960. Population changes between April 1, 1960, and July 1, 1960, are not covered by this table.

Table 7

POPULATION GROWTH IN 52 LARGE SMSA'S, 1940-1980; WEIGHTED AVERAGES FOR MAJOR GEOGRAPHIC DIVISIONS

Census Division and Region	Number of SMSA's Included	Percentage Change in Population During Decade			
		Intercensal[a]		RAND Series II Projections[b]	
		1940-1950	1950-1960	1960-1970	1970-1980
United States total	52	22.5	26.4	23.1	24.1
Northeast					
New England	3	9.5	10.2	9.4	12.1
Middle Atlantic	10	11.0	14.2	12.4	14.4
North Central					
East North Central	11	18.4	23.6	21.2	23.6
West North Central	3	18.2	24.3	22.5	24.9
South					
South Atlantic	6	42.5	42.2	32.2	29.8
East South Central	3	27.7	22.8	19.8	22.2
West South Central	6	40.0	41.1	32.6	31.1
West					
Mountain	2	48.9	68.8	47.9	40.2
Pacific	8	53.1	48.4	37.6	33.7

SOURCES: See Table 6.

NOTE: Populations of the large SMSA's of each Census Region were summed for each date. Figures shown are percentages of change for these regional totals.

[a,b] See Table 6.

among the eight largest, there are radical exceptions to the rule of slow growth; Los Angeles, moving from fourth to second place in size, grew five times as fast as New York, 1940-1960--much more rapidly than many smaller places.

The inverse relationship between size and rate of growth nevertheless persists when the 52 SMSA's are grouped by geographic region, although the differences between the unweighted average and the

regional aggregate rates of growth are much smaller. The relevant figures are shown in Tables 6 and 7 for nine regional groupings established by the Census Bureau. The boundaries of these Census Regions are shown in Fig. 1.

More significantly, these tables reveal the family resemblance in growth patterns of SMSA's within each region, and the great differences among regions in this respect. Whether we consider the unweighted average growth rate for each region (Table 6) or the weighted average (Table 7) the same pattern is apparent. In the period 1940-1960, the SMSA's of the Mountain and Pacific Regions grew about five times as fast as those of the New England and Middle Atlantic Regions, nearly three times as fast as those of the North Central states, and about 1.5 times as fast as the South Atlantic and West South Central Regions. The greatest acceleration of growth came in the Western Mountain Region, while the greatest deceleration was in the East South Central Region.

Various studies of differential population growth in the United States* recognize the importance of the "regional factor," but none has yet rigorously accounted for regional differences in growth rates. Examining the broad configuration of state-by-state population growth (Figs. 2 and 3 for 1940-1950 and 1950-1960, respectively) suggests some quite plausible notions of the basic factors at work. The areas of most rapid growth are predominantly coastal, including those states abutting on the Great Lakes, but the Inland Southwest has grown at a healthy rate while the New England states have grown only slowly despite their Atlantic frontage. The states of slowest growth form a gigantic V whose base is located near the Gulf of Mexico (say, Mobile,

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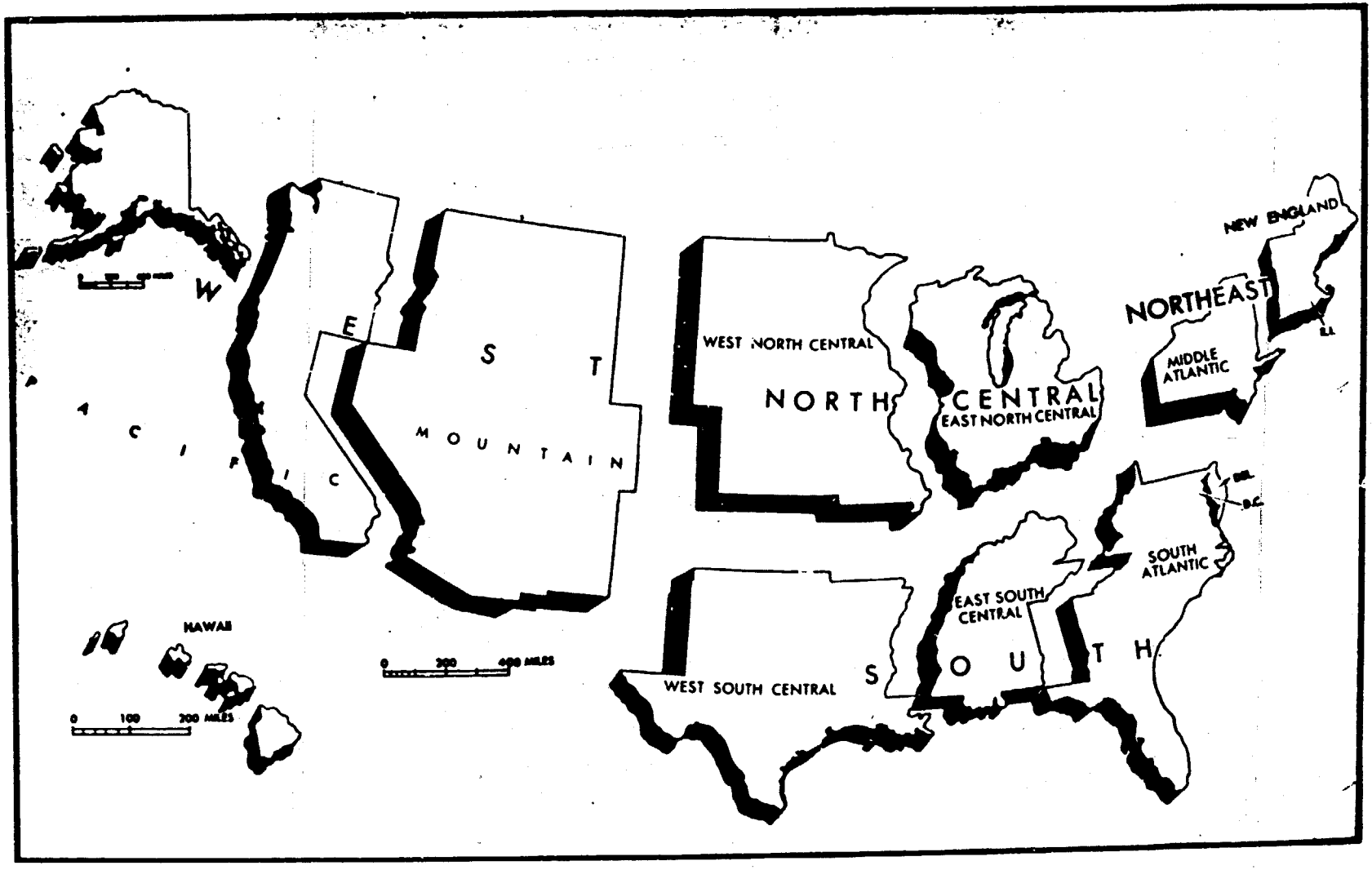
*Cf. Victor R. Fuchs, Changes in the Location of Manufacturing in the United States Since 1929, New Haven and London, Yale University Press, 1962, esp. Ch. 4, where some interesting correlatives of "net cumulative migration" (to states) are discussed. The American Philosophical Society's study, Population Distribution and Economic Growth, United States 1870-1950, directed by Simon Kuznets and Dorothy Swaine Thomas, promises to be the definitive work on differential growth by states. Two volumes of reference tables and preliminary analysis have so far been published (Philadelphia, 1957 and 1960); an additional analytical volume is promised.

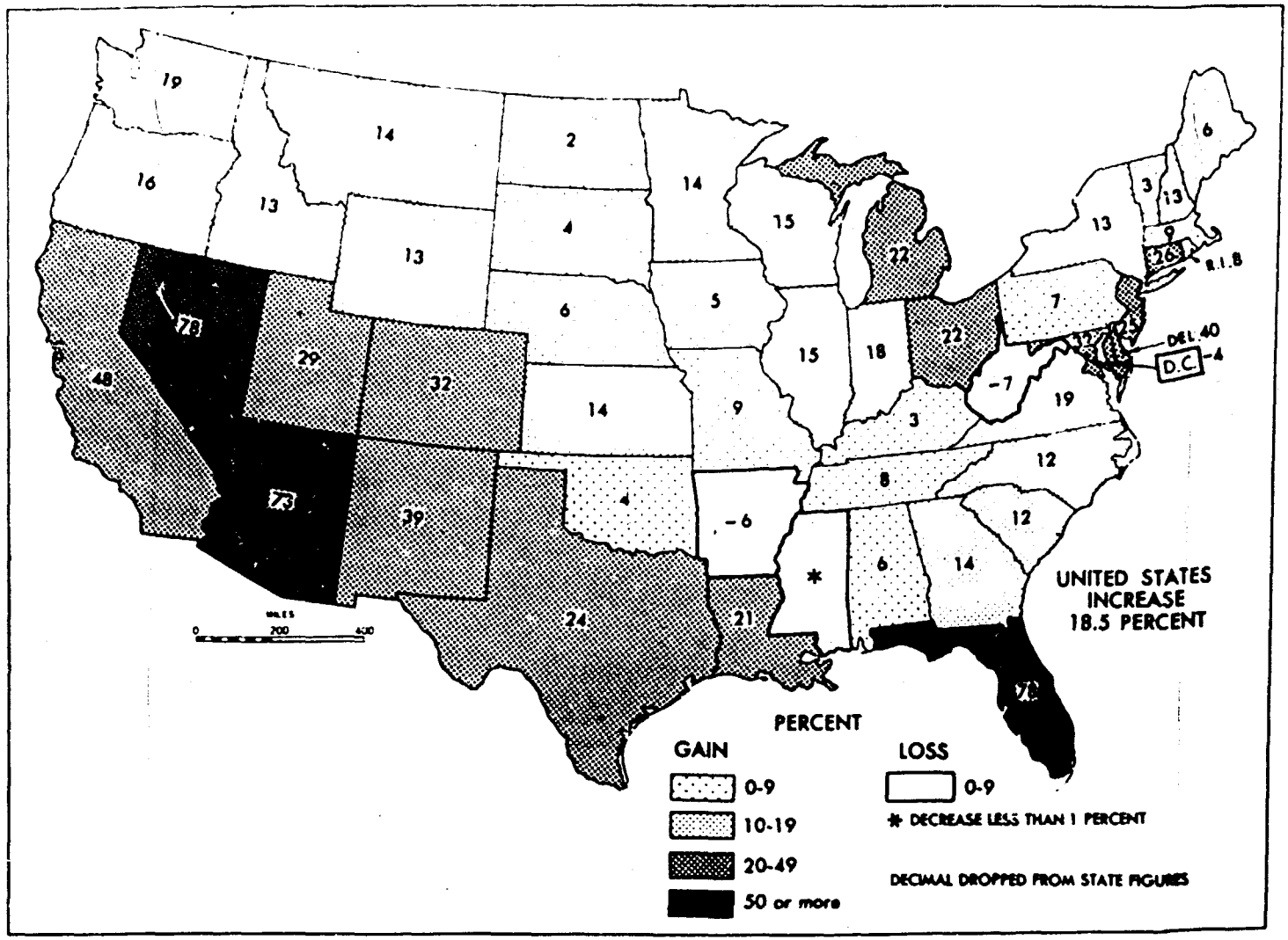


SOURCE: U.S. BUREAU OF THE CENSUS

Fig. 1 - Regions and Geographic Divisions of the United States

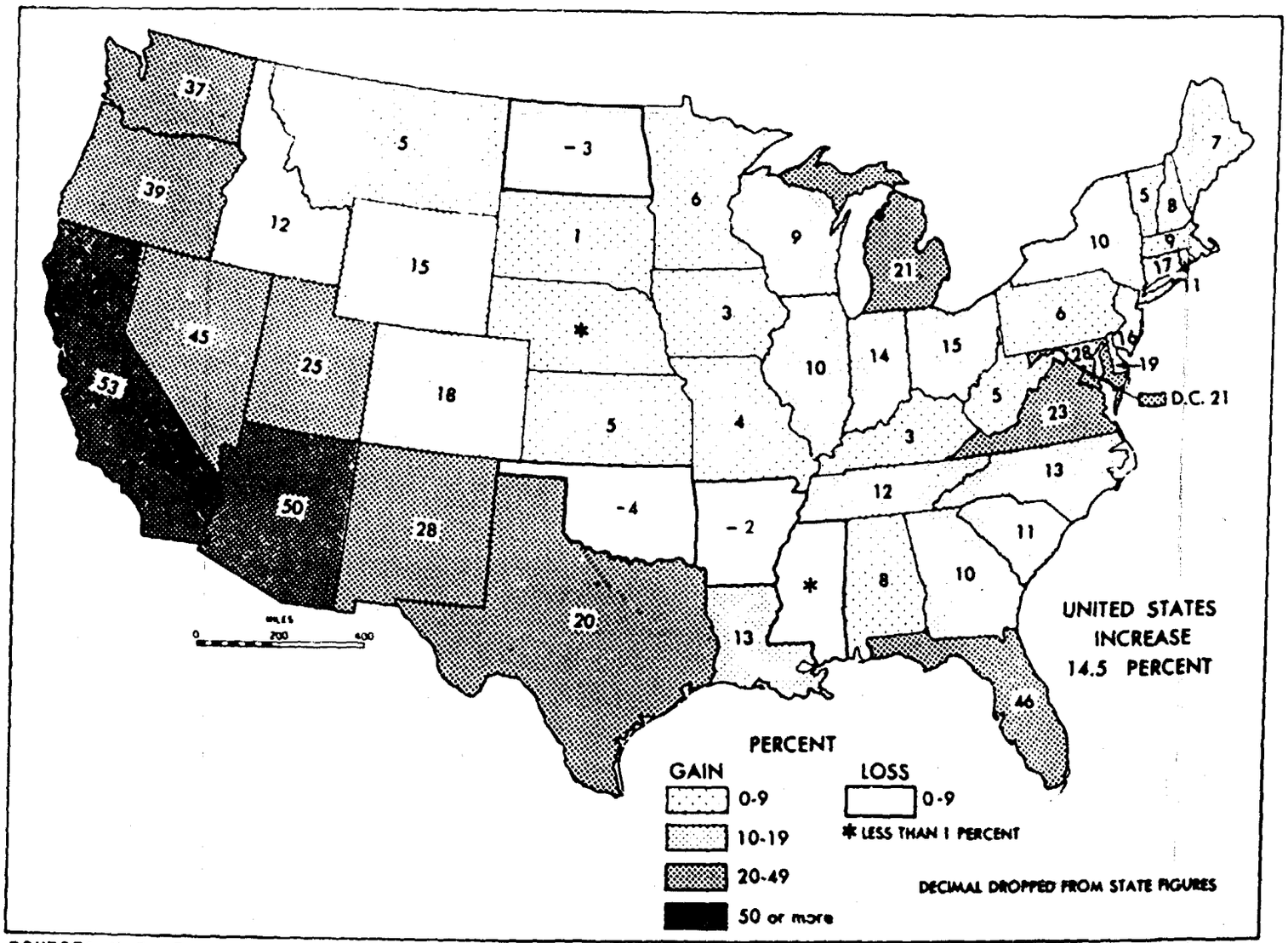
SOURCE: U.S. BUREAU OF THE CENSUS

Fig. 1 - Percentage Change in Total Population, by States: 1950 to 1960



SOURCE: U.S. BUREAU OF THE CENSUS

Fig. 2 - Percentage Change in Total Population, by States: 1950-1960



SOURCE: U.S. BUREAU OF THE CENSUS

Alabama). The right arm of the V extends along the western slope of the Appalachians to Maine; the left arm reaches to the Dakotas.

The pattern suggests three underlying explanatory factors, each operating on population growth through a chain of intervening variables. The factors are climate, transportation, and ratio of resources to people. Thus, those coastal areas where growth is most rapid are doubly blessed with mild climates and good port facilities; the sparsely settled but rapidly growing southwest has the twin advantages of a higher ratio of resources to people, and a more congenial climate than the Mississippi-Missouri watershed.

Yet, even in areas of slow over-all population growth, individual SMSA's may grow at respectable rates. For instance, the State of Oklahoma lost population between 1940 and 1960, but the Oklahoma City SMSA grew at the rate of 30 per cent per decade. While the rural portion of the state experienced net out-migration in excess of natural increase, the SMSA experienced an influx of migrants, partly from the surrounding countryside.

Depopulation or slow growth of rural areas remote from large cities has been the rule rather than the exception in the United States for several decades. It occurs because of heavy migration to urban places, both nearby and distant. The movement is mainly induced by the greater rewards of urban employment and the wider spectrum of consumer goods and services available there. But as our tables (and Fig. 4) show, those SMSA's which are fortunately situated in the regional sense have received the lion's share of the migrants, hence of the total growth.

How will this regional pattern of SMSA growth evolve in the coming decades? The last two columns of Tables 6 and 7 summarize RAND Series II projections, which are based on the assumption that each SMSA will experience the same absolute volume of net migration in the coming decades as it did 1950-1960. The effect of this assumption is clearly visible in the tables: Those SMSA's which have been growing rapidly as a consequence of in-migration are projected to grow at diminishing rates to 1980, whereas those SMSA's whose growth was largely attributable to natural increase (net migration, whether positive or negative,

Fig. 4 - Changes in Population of Standard Metropolitan Statistical Areas: 1950 to 1960

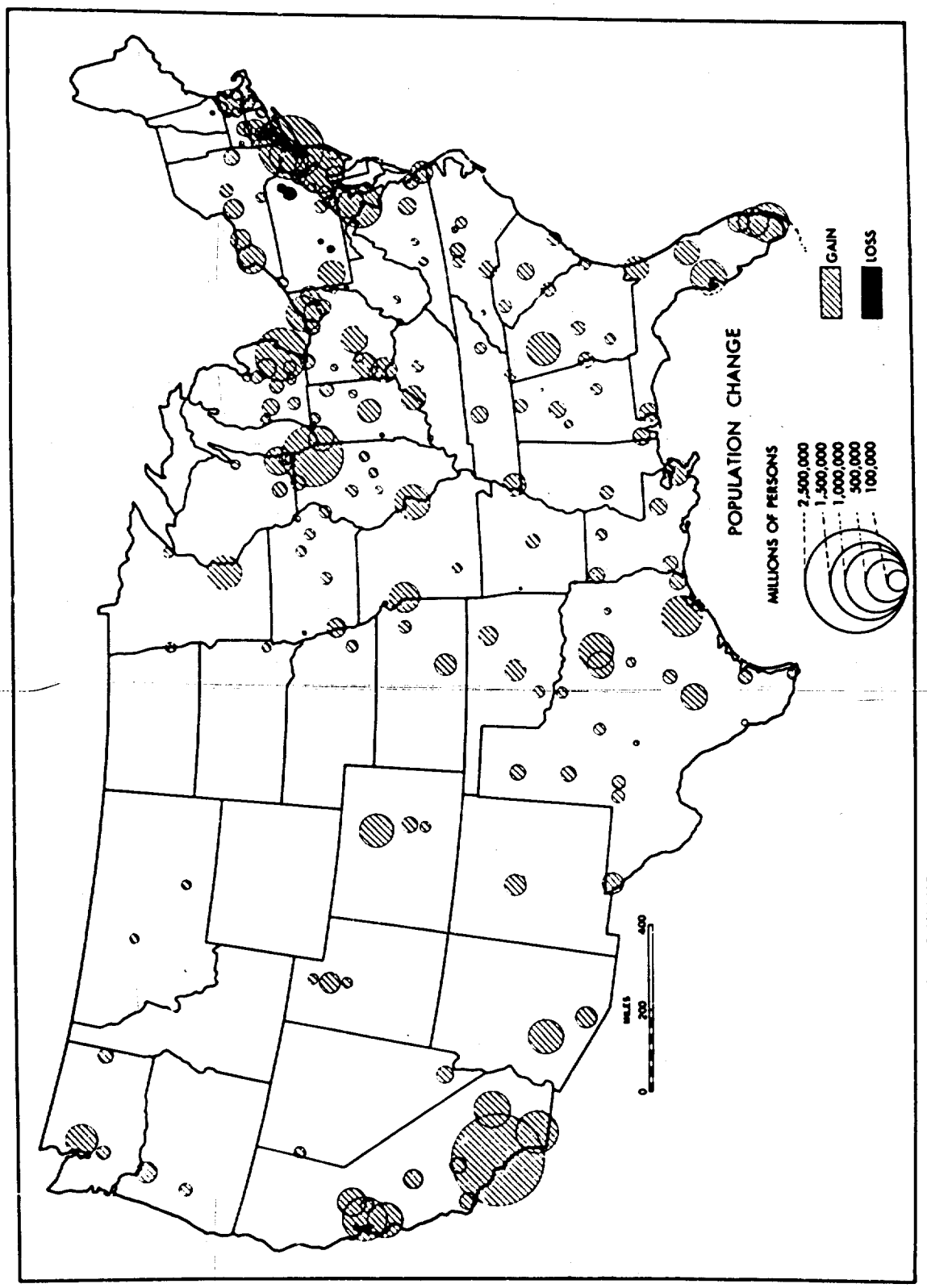


Fig. 4 - Changes in Population of Standard Metropolitan Statistical Areas: 1950 to 1960

playing a minor role) are projected to grow at about their 1950-1960 rates. For all SMSA's, the rate of growth in the 1960's is depressed by the anticipated shortage of births during a decade in which female age-composition is relatively unfavorable to child-bearing. This effect shows most clearly in the northeastern and North Central SMSA's; elsewhere migration effects tend to obscure it.

V. NON-WHITE POPULATIONS OF LARGE SMSA'S

In 1900 only 1 per cent of the nation's non-white population lived outside the South and only 23 per cent lived in "urban" places of 2 500 or more inhabitants. By 1960, more than 42 per cent of all non-whites lived outside the South, and 72 per cent lived in urban places. These statistics bracket one of the nation's major streams of internal migration: the movement of Negroes* from the rural South to the cities of the North and West.

To exaggerate this movement or misrepresent its significance is easy. The depopulation of the rural South has its counterpart in the depopulation of the rural North, and rural whites as well as Negroes are moving to the nation's cities. But Negro migration since 1900 has been relatively greater than that of Southern whites, and the non-white fraction of the remaining Southern population has fallen from 33 per cent at the turn of the century to 12 per cent in 1960 despite the greater fertility of non-whites. And while the nation's whites were three times as "urban" as non-whites in 1900, by 1960 non-whites were the more urban group (72 per cent lived in urban places, as compared to 70 per cent of all whites).

The net migration estimates compiled for this report do not specify the origins of migratory flows, nor do they indicate the gross in-and-out movements. There is considerable evidence that the cities of the South serve as way-stations for rural Negroes who subsequently move

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*The Census Bureau defines non-whites to include "Negro, Indian, Japanese, Chinese, Filipino, Korean, Asian Indian, and Malayan races. Persons of Mexican birth or ancestry who are not definitely of Indian or other non-white race are classified as white.... Persons of mixed racial parentage are classified according to the race of the non-white parent." (U.S. Census of Population: 1960, Series PC(1)-1B, General Population Characteristics, p. ix.) The Census definition was followed in the present study.

About 11 per cent of the population of the U.S. in 1960 was classified as non-white, and about 94 per cent of all non-whites were classified as Negroes. Thus, with the exception of a few communities containing Oriental colonies, "non-white" and "Negro" are virtually congruent classifications.

to cities elsewhere in the nation.* In any event, the fifteen largest SMSA's of the South had an estimated net influx of 271,000 non-whites between 1950 and 1960, whereas the 37 largest SMSA's in the remainder of the nation received 1,420,000 non-whites.

Assuming that the migration pattern of the 1950's prevails in the coming decades, and taking into account differential rates of birth and death for whites and non-whites, we can project the racial composition of the 52 large SMSA's covered by this report. These projections are summarized for Census Regions in Table 8, with detail for individual SMSA's given in Table 9.

Among the 15 southern SMSA's, only Birmingham and Norfolk-Portsmouth experienced a significant net out-migration of non-whites, 1950-1960, and this loss is reflected in the declining ratio of non-whites to total population which is projected for 1970 and 1980. The case of Birmingham is particularly striking: Between 1950 and 1960, the non-white exodus from the SMSA amounted to 14 per cent of the 1950 non-white population, while white out-migration was negligible. Most southern SMSA's can expect slowly rising fractions of non-whites, although in Memphis, Atlanta, and Tampa the trends in racial composition are uncertain.

The bulk of the non-white migration is directed to the largest SMSA's of the East North Central and Middle Atlantic Regions. If 1950-1960 migration patterns continue, New York will have nearly 2.5 million non-whites by 1980, with another 700,000 settled in Newark, Jersey City, and Patterson. Over-all, about a fifth of the population of the New York Consolidated Area will be non-white.

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*See U.S. Bureau of the Census, 1960 Census of Population, Series PC(2)-2C, Mobility for Metropolitan Areas, for supporting data. A recent study based on these data suggests that "patterns of Negro migration may have been changing. Very likely a high status, inter-metropolitan stream of Negro migrants has always existed, but has increased substantially in recent years with the rapid urbanization of the Negro population. The Negro population has changed from a disadvantaged rural population to a metropolitan population of increasing socio-economic levels, and its patterns of migration have become very much like those of the white population." From Alma F. and Karl E. Taeuber, "The Changing Character of Negro Migration to Cities,"

Table 8

NON-WHITE POPULATION AS PERCENTAGE OF TOTAL,
52 LARGEST SMSA'S, 1950-1980;
SUMMARY BY GEOGRAPHIC DIVISIONS

	1950	1960	1970	1980
TOTAL, 52 SMSA'S	9.8	12.0	14.0	16.0
NORTHEAST				
NEW ENGLAND	2.1	3.1	4.3	5.5
MIDDLE ATLANTIC	8.2	10.9	13.7	16.4
NORTH CENTRAL				
EAST NORTH CENTRAL	10.2	13.5	16.5	19.4
WEST NORTH CENTRAL	8.7	9.7	10.8	12.1
SOUTH				
SOUTH ATLANTIC	20.9	21.3	22.4	24.0
EAST SOUTH CENTRAL	28.1	26.7	26.1	26.6
WEST SOUTH CENTRAL	15.8	16.8	18.1	19.6
WEST				
MOUNTAIN	4.4	4.8	5.1	5.6
PACIFIC	6.2	8.2	9.5	10.6

SOURCES: 1950 and 1960, U.S. Census of Population; 1970 and 1980, RAND Series II projections.

NOTE: Percentages are based on the total populations of selected SMSA's in each geographic division; see Table 9 for a list of SMSA's included. All data refer to SMSA's as defined in 1960.

Table 9

NON-WHITE POPULATION AS PERCENTAGE OF TOTAL, 52 LARGEST SMSA'S 1950-1980; DETAIL BY GEOGRAPHIC DIVISIONS

	1950	1960	1970	1980
NEW ENGLAND				
BOSTON	2.0	2.9	4.1	5.3
PROVIDENCE	1.6	2.1	2.8	3.7
HARTFORD	3.1	4.8	6.3	7.6
MIDDLE ATLANTIC				
NEW YORK	8.9	12.1	15.5	18.8
PHILADELPHIA	13.2	15.8	18.4	21.0
PITTSBURGH	6.2	6.8	7.7	8.8
NEWARK	9.2	13.6	18.1	22.4
BUFFALO	4.4	6.9	9.4	11.7
PATERSON	2.7	3.8	4.8	5.7
ALBANY	1.7	2.7	3.9	5.1
JERSEY CITY	3.7	7.1	12.3	20.2
ROCHESTER	1.7	4.3	7.0	9.5
SYRACUSE	1.4	2.6	3.8	4.9
EAST NORTH CENTRAL				
CHICAGO	10.7	14.9	19.0	23.0
DETROIT	12.0	15.1	18.0	20.6
CLEVELAND	10.5	14.6	18.2	21.4
MILWAUKEE	2.5	5.7	8.8	11.8
CINCINNATI	10.6	12.1	13.6	15.1
INDIANAPOLIS	11.8	14.5	16.9	19.2
DAYTON	8.5	10.2	11.6	12.8
COLUMBUS	10.4	12.0	13.2	14.3
GARY	12.5	15.4	17.6	19.8
AKRON	6.5	8.2	9.8	11.3
YOUNGSTOWN	7.6	9.3	11.0	12.8
WEST NORTH CENTRAL				
ST LOUIS	12.6	14.5	16.6	18.8
MINNEAPOLIS	1.3	1.9	2.3	2.8
KANSAS CITY	10.8	11.4	12.2	13.5
SOUTH ATLANTIC				
WASHINGTON,D.C.	23.4	25.0	26.6	28.2
BALTIMORE	19.4	22.2	25.4	28.7
ATLANTA	23.8	22.8	22.7	23.4
MIAMI	13.2	14.9	16.9	19.0
TAMPA	13.9	11.5	11.8	12.8
NORFOLK	27.5	26.4	25.6	25.8
EAST SOUTH CENTRAL				
LOUISVILLE	11.5	11.6	11.9	12.7
BIRMINGHAM	37.3	34.6	32.4	31.6
MEMPHIS	37.4	36.4	36.5	38.2
WEST SOUTH CENTRAL				
HOUSTON	18.7	20.1	21.5	23.1
DALLAS	13.5	14.6	15.9	17.5
NEW ORLEANS	29.3	31.1	33.4	36.2
SAN ANTONIO	6.7	6.9	7.1	7.4
FORT WORTH	10.6	10.7	11.1	11.9
OKLAHOMA CITY	7.3	9.5	11.6	13.9
MOUNTAIN				
DENVER	3.4	4.2	4.8	5.4
PHOENIX	6.4	5.5	5.5	5.8
PACIFIC				
LOS ANGELES	6.3	8.9	10.5	11.8
SAN FRANCISCO	9.4	12.5	15.3	17.8
SEATTLE	3.7	4.8	5.7	6.4
SAN DIEGO	4.3	5.5	6.4	7.2
PORTLAND	2.3	3.0	3.8	4.5
SAN BERNARDINO	3.7	4.7	5.4	6.0
SAN JOSE	3.5	3.2	3.2	3.2
SACRAMENTO	8.6	7.6	8.1	8.6

SOURCES and NOTES: See Table 8.

Roughly the same proportions will prevail in Philadelphia, Chicago, Gary-Hammond-East Chicago, Detroit, Cleveland, and Indianapolis. (In Chicago, non-whites will constitute as large a fraction of the total population as in Atlanta or Houston.) On the West Coast, Los Angeles-Long Beach will be the center of non-white population, with a projected 1.5 million such persons by 1980, or about 12 per cent of the total population. San Francisco-Oakland will hold about half that number of non-whites,* but they will amount to nearly 18 per cent of the total population.

The projected ethnic mixes contrast vividly with those recorded by the Census of 1950, when the largest non-white population outside the South was New York's 850,000, and when Philadelphia's 13 per cent non-white fraction was the largest of any among the 37 SMSA's outside the South.

The smaller SMSA's of the North and West are apparently less attractive to non-white in-migrants, and many of these may reach 1980 with populations which are more than 90 per cent white. Of the SMSA's covered by this report, Minneapolis-St. Paul seems least likely to have a "race" problem in the coming decades, for its projected non-white population amounts to less than three per cent of the total.

Considerable uncertainty attaches to projections of non-white migratory movements because of the current national struggle over the civil status of Negroes. It is perhaps significant that Birmingham, the earliest focus of this struggle, experienced the largest Negro out-migration of all southern SMSA's during the 1950's. Not until the Census of 1970 has been taken will we be able to estimate the migratory movements of the present decade, but I venture that Negroes are now leaving the South at a greater rate than during the 1950's.

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unpublished paper presented at the meetings of the Population Association of America, June 1964.

*In the case of San Francisco, the non-white population will include a substantial number of Orientals; in 1960, Chinese, Japanese, and Filipinos constituted 41 per cent of that SMSA's non-whites, but this fraction will decline over time. (Oriental immigration is limited by law to an insignificant number, while Negro in-migration is not.)

VI. AGE-DISTRIBUTION OF METROPOLITAN POPULATIONS

Since the founding of the republic, the population of the United States has been getting older. In 1820, the median age was 16.7 years; in 1900, it was 22.9 years; and in 1950, reached a peak of 30.2 years. The "baby boom" following World War II reversed this trend at least temporarily; by 1960 the median age of the American population had fallen to 29.5 years.*

Two factors account for this gradual aging of the U.S. population: increasing longevity and decreasing fertility. During the 1930's, when birth rates were at their lowest, many demographers believed that our nation (and other industrial nations) had reached a new equilibrium between births and deaths that implied a permanently "old" population and little further growth in numbers. In retrospect, it is evident that many women who "economized" on children during the Great Depression made up their deficits during the more prosperous 1940's; their younger sisters produced babies at rates unmatched since the early 1920's.** Since death rates continued to fall, the consequence was a marked acceleration in population growth, and a slight decline in median age.

Any variation in the size of successive birth cohorts reflects naturally in the subsequent age-composition of the population. Thus, in 1960 there were fewer persons 20-24 years of age (born 1935-1939) than in any bracket of equal span up to 50-54 years--despite the greater mortality among older cohorts. (See Table 10, Column 1.) The relatively small size of both cohorts born in the 1930's reflects also in the decline in the annual number of births during the late 1950's, when these cohorts were passing through the years of peak fertility.***

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*The figures cited for 1820 and 1900 are from Bogue, The Population of the United States, p. 95. Figures for 1950 and 1960 are from the 1960 Census of Population, Final Report PC(1)1B, Table 45, and they exclude the inhabitants of outlying U.S. possessions.

**See Pascal K. Whelpton, Cohort Fertility: Native White Women in the United States, Princeton University Press, Princeton, N. J., 1954, Ch. 6.

***Interpretation of birth statistics for this period is complicated by the termination in 1959 of the NVSD's traditional adjustment

The birth cohorts of the 1940's were larger. By 1965, the number of women in the age-bracket 20-24 years will be about 20 per cent greater than it was in 1960, and by 1970, more than 50 per cent greater. Consequently, we may anticipate a sharp upward trend in births in the next few years, even allowing for continued decline in age-specific fertility.

The impact of the events described above is fairly uniform over the nation, but migration modifies the age-structures of local populations. The populations of areas most subject to in-migration concentrate in the middle years; elderly persons and children tend to be under-represented. Table 10 indicates one aspect of these differentials and Table 11 another.

The last three columns of Table 10 show metropolitan and non-metropolitan populations differences in age-composition in 1960. As compared to the non-metropolitan population of the U.S., small SMSA's reported larger fractions of their inhabitants in every age-bracket between 20 and 54 years of age, and smaller fractions for ages 55 and over. There was a similar "excess" of working-age persons in the 52 largest SMSA's, but they tended to be somewhat older than in the small SMSA's, concentrated in the range from 25 to 64 years of age.

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for under-registration, and by the addition of Alaska (1959) and Hawaii (1960) to the U.S. series. The unadjusted series excluding Alaska and Hawaii, would read as follows:

Year	Total live births
1955	4,047,000
1956	4,163,000
1957	4,255,000
1958	4,204,000
1959	4,238,000
1960	4,233,000
1961	4,243,000

Coincidentally, age-specific birth rates seem to have turned down at about the time that the "shortage" of mothers became evident. See Pascal K. Whelpton, "Why Did the United States' Crude Birth Rate Decline During 1957-1962?," in Population Index, Vol. 29, No. 2, April 1963.

Table 10

AGE-DISTRIBUTION OF THE POPULATION OF THE UNITED STATES, METROPOLITAN AND NON-METROPOLITAN, 1960

Age Group (yr)	Percentage Distribution by Age			
	U.S. Total[a]	Non-Metro-politan	160 Small SMSA's	52 Large SMSA's
All ages	100.0	100.0	100.0	100.0
0- 4	11.3	11.3	12.2	11.2
5- 9	10.4	10.8	11.0	10.0
10-14	9.4	10.1	9.6	8.7
15-19	7.4	8.2	7.7	6.7
20-24	6.0	5.9	6.7	5.9
25-29	6.1	5.6	6.6	6.3
30-34	6.7	6.0	7.1	7.1
35-39	7.0	6.3	7.3	7.5
40-44	6.5	6.0	6.6	6.8
45-49	6.1	5.8	6.1	6.3
50-54	5.4	5.2	5.3	5.6
55-59	4.7	4.6	4.5	4.9
60-64	4.0	4.0	3.8	4.1
65-69	3.5	10.2	8.6	3.5
70 and over	2.6			5.4

SOURCE: U.S. Census of Population, 1960.

NOTE: Percentages may not add exactly to 100.0 because of rounding.

[a]Does not include the population of Puerto Rico or other outlying U.S. possessions.

As compared to the non-metropolitan population, youth (0-19 years) was under-represented in the large SMSA's; but the smaller SMSA's had the highest proportion of children under 10, a finding predictable from their equally high proportion of young adults, 20-29 years.

Table 11 summarizes, for broader age-groups, the regional differences in the age-structure of the populations of our 52 large SMSA's. The first two columns are calculated from census data for 1950 and 1960; the third and fourth columns are based on RAND Series II projections. Several interesting observations can be made from this table:

1) The SMSA's of each region had significantly different age-structures, both in 1950 and 1960. Those SMSA's located in the most rural parts of the nation (e.g., the East and West South Central states and the Mountain states of the west) had the highest proportions of school-age children and the lowest proportions of persons over 65. The pattern is reversed for the SMSA's of the highly urbanized New England states.

2) The changes in age-structure between 1950 and 1960 were drastic, and in every case tended to increase the "dependency rate" of these metropolitan residents. In New England, for example, 33.0 per cent of the 1950 metropolitan population was under 15 or over 65 years of age; in 1960, 39.4 per cent fell in these dependent age-groups. If the birth rate and migration assumptions of RAND Series II projections are correct, the ratio of dependents to labor-force "eligibles" will remain at about the 1960 level over the next two decades.

3) The labor force (persons 15-64 years of age) was exceptionally old in 1960 and will be exceptionally young by 1980. The table divides the labor-force eligibles into two age brackets: 15-39 years and 40-64 years. Again taking New England as an example, the ratio of the former group to the latter was 1.26 in 1950, and 1.14 in 1960. By 1970 this ratio is projected to increase to 1.23, and by 1980 to 1.66. A similar pattern of change is visible in the large SMSA's of each Census Region.

Table 11

AGE DISTRIBUTION OF THE POPULATIONS OF 52 LARGEST SMSA'S, 1950-1980, SUMMARY BY GEOGRAPHIC DIVISION

	1950	1960	1970	1980
NEW ENGLAND	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	23.5	28.7	29.9	30.5
AGE 15-39 YEARS	37.4	32.3	33.2	37.5
AGE 40-64 YEARS	29.6	28.4	27.0	22.5
AGE 65+ YEARS	9.5	10.7	10.0	9.6
MIDDLE ATLANTIC	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	24.7	27.8	28.5	29.3
AGE 15-39 YEARS	38.3	32.6	33.4	37.0
AGE 40-64 YEARS	31.0	30.0	28.5	24.1
AGE 65+ YEARS	8.0	9.6	9.6	9.6
EAST NORTH CENTRAL	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	24.3	31.2	32.1	33.0
AGE 15-39 YEARS	38.8	33.1	34.4	37.7
AGE 40-64 YEARS	29.6	27.4	25.9	22.0
AGE 65+ YEARS	7.2	8.3	7.6	7.3
WEST NORTH CENTRAL	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	24.1	31.7	33.2	34.1
AGE 15-39 YEARS	38.0	32.6	34.2	37.7
AGE 40-64 YEARS	29.4	26.4	24.3	20.6
AGE 65+ YEARS	8.5	9.2	8.4	7.6
SOUTH ATLANTIC	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	24.6	30.2	30.4	31.2
AGE 15-39 YEARS	41.6	34.9	35.5	37.5
AGE 40-64 YEARS	26.9	26.6	25.7	22.9
AGE 65+ YEARS	6.8	8.3	8.3	8.4
EAST SOUTH CENTRAL	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	27.3	33.0	33.0	33.9
AGE 15-39 YEARS	39.8	33.8	35.3	38.2
AGE 40-64 YEARS	26.1	25.3	23.9	20.2
AGE 65+ YEARS	6.8	7.8	7.8	7.6
WEST SOUTH CENTRAL	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	26.6	32.9	32.7	33.4
AGE 15-39 YEARS	41.3	35.4	36.4	38.3
AGE 40-64 YEARS	26.0	24.8	24.1	21.5
AGE 65+ YEARS	6.1	6.8	6.8	6.8
MOUNTAIN	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	26.8	33.0	32.8	33.1
AGE 15-39 YEARS	39.3	34.9	35.8	37.4
AGE 40-64 YEARS	26.1	24.4	24.4	22.6
AGE 65+ YEARS	7.7	7.8	7.0	7.0
PACIFIC	100.0	100.0	100.0	100.0
AGE 0-14 YEARS	23.7	30.1	30.4	31.2
AGE 15-39 YEARS	38.5	34.3	35.7	37.5
AGE 40-64 YEARS	29.1	26.7	26.0	23.6
AGE 65+ YEARS	8.8	8.9	7.9	7.7

SOURCES: 1950 and 1960, U.S. Census of Population; 1970 and 1980, RAND Series II (midyear) projections.

NOTE: See Table 9 for names of selected SMSA's in each geographic division. Percentages may not add exactly to 100.0 because of rounding.

Finer detail on the projected age-structure of the population of our large SMSA's is given in Table 12--at the cost of suppressing the regional variations shown in Table 11. The smallest cohort of births, 1935-1939, appears in the second column of the table as those persons 20-24 years of age in 1960. This cohort can be traced across the table of quinquennial projections to 1985, when its members will be 45-49 years of age. Since the birth cohorts preceding and following that of 1935-1939 were larger in size, the aging of this cohort is the key to the shift from a relatively old to a relatively young labor force during the 25 years covered by the projections.

Table 12 also suggests a minor crisis in the immediate future, as the large birth-cohorts of 1945-1955 reach the age at which they are ready to enter either college or the labor force. In 1960, our 52 SMSA's contained 5.5 million persons 15-19 years of age; in 1965, this age-group will number nearly 7.4 million persons, an increase of 35 per cent. It is fairly clear that the nation is not prepared to cope with these accessions to adulthood, and we must anticipate both crowded campuses and crowded poolrooms for the rest of the decade. The size of this age-group continues to increase, but the pace of growth slackens after 1965: 18 per cent, 1965-1970; 13 per cent, 1970-1975; and 7 per cent, 1975-1980. After 1980, however, the children of the first postwar generation will begin to reach this crucial age, and the cycle once more turns upward.

Retirement and the care of the urban aged promise to be more manageable problems, at least in terms of magnitude. In 1960, our 52 SMSA's contained nearly 7.2 million persons over 65 years of age. The number is projected to increase to 11.1 million by 1985; quinquennial rates of growth are quite modest, though they do accelerate from 7.4 per cent for 1960-1965 to 10.5 per cent for 1975-1980.

Table 12

PERCENTAGE DISTRIBUTION BY AGE, TOTAL POPULATION
OF 32 LARGE SMSA'S, 1950-1985

AGE GROUP	1950	1960	1965	1970	1975	1980	1985
TOTAL, ALL AGES	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0-5 YEARS	10.0	11.2	10.9	11.0	11.5	11.7	11.6
5-9 YEARS	7.8	10.0	10.3	10.0	10.1	10.5	10.7
10-14 YEARS	6.2	8.7	9.4	9.6	9.3	9.3	9.7
15-19 YEARS	6.1	6.7	8.2	8.7	8.8	8.5	8.6
20-24 YEARS	7.7	5.9	6.6	7.8	8.2	8.3	8.0
25-29 YEARS	8.7	6.3	6.0	6.6	7.6	7.8	7.9
30-34 YEARS	8.3	7.1	6.1	5.8	6.2	7.1	7.3
35-39 YEARS	8.1	7.5	6.6	5.7	5.6	5.8	6.5
40-44 YEARS	7.4	6.8	6.8	6.0	5.2	4.9	5.2
45-49 YEARS	6.6	6.3	6.2	6.1	5.4	4.7	4.4
50-54 YEARS	6.1	5.6	5.6	5.5	5.4	4.7	4.1
55-59 YEARS	5.2	4.9	4.8	4.8	4.7	4.6	4.1
60-64 YEARS	4.2	4.1	4.0	4.0	4.0	3.9	3.8
65-69 YEARS	3.3	3.5	3.2	3.2	3.1	3.1	3.1
70+ YEARS	4.5	5.4	5.3	5.2	5.1	5.0	5.0

SOURCES: 1950 and 1960, U.S. Census of Population; 1965-1985, RAND Series II (midyear) projections.

NOTE: Percentages may not add exactly to 100.0 because of rounding.

VII. CONCLUSION

REVIEW OF FINDINGS

This Memorandum reports the results of two series of population projections, 1960-1985, for each of 52 large SMSA's. The two series are based on identical assumptions as to the future incidence of births and deaths among the residents of each metropolis, but differ with respect to migration. Series I assumes zero net migration to 1985; Series II extends the migration experience of each SMSA from the decade 1950-1960 into the future, assuming equal numbers of migrants each quinquennium.

The populations projected in Series I serve primarily as benchmarks against which the results of alternative migration assumptions can be measured. The populations projected in Series II were found to conform closely to the expectations of those local agencies which have prepared population forecasts or projections for their own SMSA's. The implications of the second series were therefore subjected to closer scrutiny.

Assuming continuation of the migration flows of 1950-1960, the total population of the 52 SMSA's included in this study will grow at the rate of 23-24 per cent per decade, only slightly faster than the population of the nation as a whole. The smaller SMSA's are projected to grow more rapidly than the larger ones, and those which grew most rapidly between 1940 and 1960 will lose considerable momentum in the coming decades.*

The Series II projections thus indicate that the aggregate population of the 52 largest SMSA's will grow from 80 million in 1960 to 124 million in 1980. New York and Los Angeles will each contain about 13 million people in 1980, as compared with 10.7 and 6.7 millions, respectively, in 1960. At least 40 of these SMSA's are projected to exceed a million inhabitants by 1980, as compared to 24 in 1960.

When SMSA's are grouped regionally, those of the Western States

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*This last finding is implicit in the Series II assumption of constant volumes of migration; see above p. 26.

give promise of growth three to four times as rapid as those of the Northeast. The SMSA's of the North Central and East South Central states fall midway between these extremes, while the South Atlantic and West South Central SMSA's follow the general pattern of the metropolises of the Pacific Coast. Only Jersey City, with net out-migration of 100,000 persons per decade, is expected to suffer a net loss in population.

The pattern of non-white migration, 1950-1960, suggests a two-stage movement of Negroes from the South: first, a move from the rural South to its metropolitan communities; second, a move from these communities to SMSA's outside the South. With a few exceptions (notably Birmingham), these two streams of migration are nearly in balance, so that the racial composition of southern SMSA's is changing only slightly. But the non-white populations of SMSA's in the East North Central and Middle Atlantic states are growing rapidly. By 1980, RAND Series II projections indicate, non-whites will constitute about 20 per cent of the populations of such places as New York, Philadelphia, Chicago, Detroit, Cleveland, and Indianapolis.

Large SMSA's tend toward greater proportions of working-age residents than the nation as a whole. The dependency rate for the 52 SMSA's covered by this report (number of persons under 15 and over 64 as a percentage of total population) increased from 31.8 per cent in 1950 to 38.9 per cent in 1960. This rate will stay at about 39 to 40 per cent over the period covered by these projections, but the labor force itself will become progressively younger as the large post-war generation replaces the smaller generation of the 1930's in the age-bracket 15-64 years.

RAND Series II projections thus presage continued pressure on our large SMSA's--pressure from rapid growth in the South and West, from changing racial balances in the slower-growing SMSA's of the Northeast and North Central states. But it is important to remember that these projections are based on a quite mechanical assumption concerning migration, and that migration is a factor of prime importance in estimates of the future size and composition of an SMSA's population.

PLANS FOR FURTHER STUDY

Clearly the greatest leverage for "improvement" of these projections would come from a more subtle model of migratory behavior. Evidence accumulates that the problem of estimating future migration flows is best approached by way of the labor market. Migration responds mainly to differences in economic opportunity.* For those concerned with the growth of a particular SMSA, interlocking forecasts of economic growth and migration are well within the state of the arts, and have in fact been undertaken by several metropolitan and regional studies. Of course, no model of migration dispenses with the necessity for assumptions, but the plausibility of both economic and population projections considerably increases with interdependent treatment.

Short of undertaking a detailed study of the economic prospects of 52 separate SMSA's, what can be done in the context of the present study to improve migration projections. During the coming year I hope to prepare a third series of population projections for these 52 SMSA's. One ingredient of the new series will be explicit economic projections for the individual SMSA's, projections which are being prepared by the National Planning Association. A second ingredient will be a model of migratory behavior which relates net migration to these economic projections.**

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*The theoretical literature and empirical studies relating to internal migration are reviewed in Ira S. Lowry, "A Model of Labor-Force Migration," published as a Working Paper by the Institute of Government and Public Affairs, University of California at Los Angeles, May 1964.

**Information concerning the NPA metropolitan projection series may be obtained from Mr. Mannie Kupinsky, National Planning Association, 1606 New Hampshire Avenue, N. W., Washington, D. C. No prospectus has been published.

Concerning migration models, see the citation in the previous footnote; also, Cicely Blanco, The Determinants of Regional Factor Mobility, Ph.D. thesis in economics submitted to the Nederlande Economische Hoogeschool, Rotterdam, 1962 (privately printed). Miss Blanco's findings are summarized in "Prospective Unemployment and Interstate Population Movements," Review of Economics and Statistics, Vol. 46, May 1964, pp. 221-222.

Improvements in birth projections are also in the offing. Recent studies by the late Pascal K. Whelpton and his associates indicate that trends in cohort fertility (size of completed family) are more stable than trends in age-specific fertility for calendar years, heretofore the mainstay of birth projections. Significant technical problems remain in the use of cohort fertility for the forecasting of annual births, but some variant of the method is almost certain to replace the age-specific fertility rate in birth projections.*

Finally, it should be noted that national mortality experience since 1954 raises some questions about the confident assumption of this report that age-specific death rates will continue to decline. A recent study dealing with death statistics through 1960 concludes that, "After a long period of rapid and substantial decline, the death rate for the United States has reached the point where further decreases as experienced in the past cannot be anticipated.**

Thus, recent developments in technique and data suggest a review of the birth and death projections employed in this report; however, the main thrust of my plans for a third series of projections of metropolitan populations is toward improved estimates of future migration--an area of much greater uncertainty than either fertility or mortality. In the meantime, RAND Series I and II projections may be of service to those concerned with the future of our large metropolitan areas.

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*See Pascal K. Whelpton, Cohort Fertility: Native White Women in the United States, Princeton University Press, Princeton, N. J., 1954; Ronald Freedman, Pascal K. Whelpton, and Arthur A. Campbell, Family Planning, Sterility, and Population Growth, McGraw-Hill, New York, 1959; Pascal K. Whelpton, "Why Did the United States Crude Birth Rate Decline During 1957-1962?", in Population Index, Vol. 29, No. 2, April 1963; and U.S. Bureau of the Census, Projections of the Population of the United States by Age and Sex to 1985 (advance figures), Current Population Reports Series P-25, No. 279, February 1964.

**See U.S. National Center for Health Statistics, The Change in Mortality Trend in the United States, Vital and Health Statistics, Series 3, No. 1, 1964.

Appendix

METHODS AND ASSUMPTIONS

The population projections presented in this report rely heavily on methods and parameters developed by Albert Chevan of the Penn-Jersey Transportation Study.* My contribution so far has been the application of these methods to a new body of data, and the formulation of the problem of SMSA growth in a national, rather than a local, context.

The computational program employed in these projections was adapted from one provided by Mr. Chevan; it is written in FORTRAN for the IBM 7090 computer. The computational procedure is essentially iterative; the population of each SMSA, as reported in the 1960 Census by age, sex, and color,** is first adjusted to a mid-year basis, then subjected to the normal process of aging and to vital rates of birth and death, over time-periods of five years each. (The mid-year adjustment for 1960 is done by the vital rate method also, but with special treatment for infant deaths.) Provision is made in the program for periodically adding or subtracting a schedule of net migrants, similarly classified as to age, sex, and color. Survivors over the five-year period and persons born during the period--corrected for net migration--are then "aged" for another five years, and so on to 1985. The mid-year population of each fifth year is printed in tabular form,*** and is also

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*Mr. Chevan, in turn, has expressed his indebtedness to Mr. James D. Tarver of Oklahoma State University.

**No attempt was made to adjust the enumerated population of 1960 for reporting or processing errors, although we may do this in later projection series. Post-censal studies indicate that the published totals for the United States represent a net undercount of about 1.7 to 2.0 per cent. For non-whites, the net undercount is perhaps as much as 6.7 per cent. Age-reporting is also seriously biased; of particular interest is the estimated overcount of 8.0 per cent for males above retirement age (65 years and older). See Conrad Taueber and M. H. Hansen, "A Preliminary Evaluation of the 1960 Census of Population," presented at the meetings of the Population Association of America, April 1963 (available from the Bureau of the Census).

***Like published census enumerations, our projections are specified to the units position for each population sub-group. In our case,

available on punch-cards. The program requires less than ten seconds for execution.

The sections which follow describe in detail the assumptions underlying this set of trial projections. These assumptions are based on work--also by Mr. Chevan--completed prior to the publication of the 1960 Census of Population and the 1960 Vital Statistics reports. Since vital statistics for non-census years can be transformed into vital rates only by the use of intercensal population estimates, the 1960 data provide bench-marks of considerable value. Some of these bench-mark data have been incorporated by the present writer into the vital-rate assumptions used in these projections; for later projection series, this line of improvement will be further pursued. Mortality assumptions are more likely to be affected than fertility assumptions by the inclusion of 1960 bench-marks in the analysis, but there is no present reason to believe that such changes will materially alter the projected rates of natural increase.

FERTILITY ASSUMPTION 1

For this set of projections assumptions as to future levels of fertility were briefly as follows: The 1960 birth rate for the female age-group 20-24 years in each SMSA (computed separately for whites and non-whites) was taken as a constant for the entire projection period. The fertility of older women was assumed to decline, while that of younger women was assumed to increase slightly. The background of these assumptions and specific formulae appear below.

In the context of these projections, three elements of differential fertility can be easily distinguished on the basis of published data:

1) Short-run fluctuations in general fertility, closely associated with changing economic conditions and social disturbances (e.g., war). Usually, all age-groups are similarly affected. A convenient way to follow these fluctuations is to trace the

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this is only because it is not convenient to round large numbers on the 7090, although figures can easily be truncated to eliminate lower-order digits.

movement over time of fertility rates for women 20-24 years of age. (See Fig. 5.) This central age-group typically accounts for about a third of all births, and has the highest of all age-specific fertility rates. The latter rule applies to whites and non-whites considered separately, to metropolitan and non-metropolitan populations, and to all major regions of the United States.

2) Long-run trends in family size and in the spacing of pregnancies. For cohorts of women who have not yet reached menopause, these trends are not easy to distinguish; however, national records covering a period of more than 30 years indicate a gradual shift in age-specific fertility differentials, generally in the direction of earlier completion of families. Among whites, the fertility of women 25 years and over has steadily diminished relative to that of women under 25. Among non-whites, fertility has diminished both for women under 20, and for women 30 years and over, relative to the group 20-24 years of age. (See Figs. 6 and 7.) While age-specific fertility of all age-groups has responded to fluctuations in economic conditions, fertility differentials have been relatively insensitive to these fluctuations; they do, however, strongly reflect the age-selective conscription of males during World War II.

3) Geographic differentials in the structure of age-specific fertility rates. Among the 52 largest SMSA's, fertility of the central (20-24 years) age-group of white females varied from 293 births per 1,000 women (Phoenix, Arizona) to 198 (New York, New York). Moreover, the relationship between the fertility of this central age-group and that of surrounding age-groups also varied considerably among SMSA's. (See Tables 13 and 14.) Such geographic differentials presumably reflect the varying mix of cultural backgrounds in metropolitan populations as well as the ecological circumstances of current life in these places--such variables as age-specific sex ratios, population size and density, real income, climate, the nature of employment opportunities, the current level of unemployment, etc.

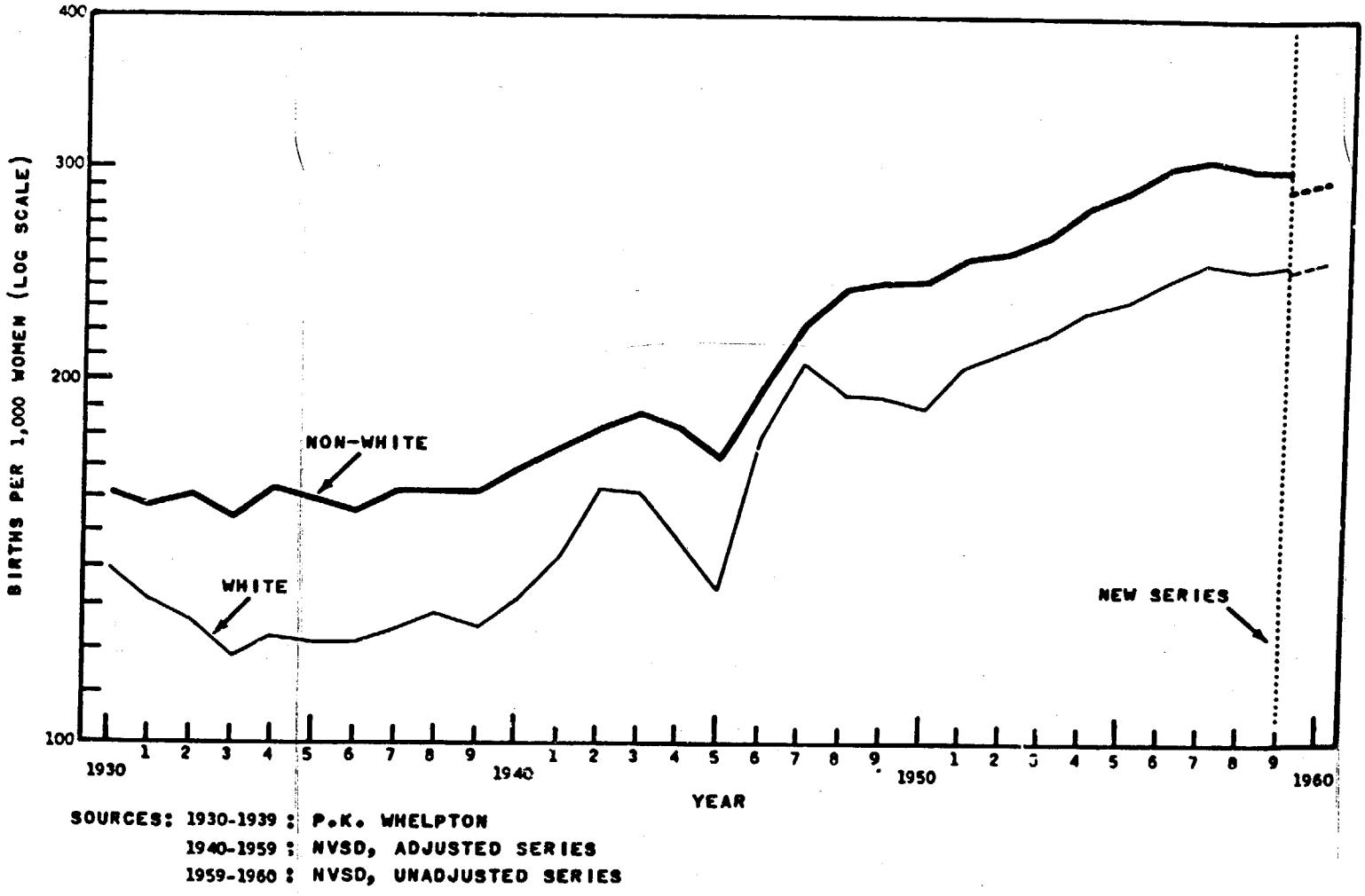
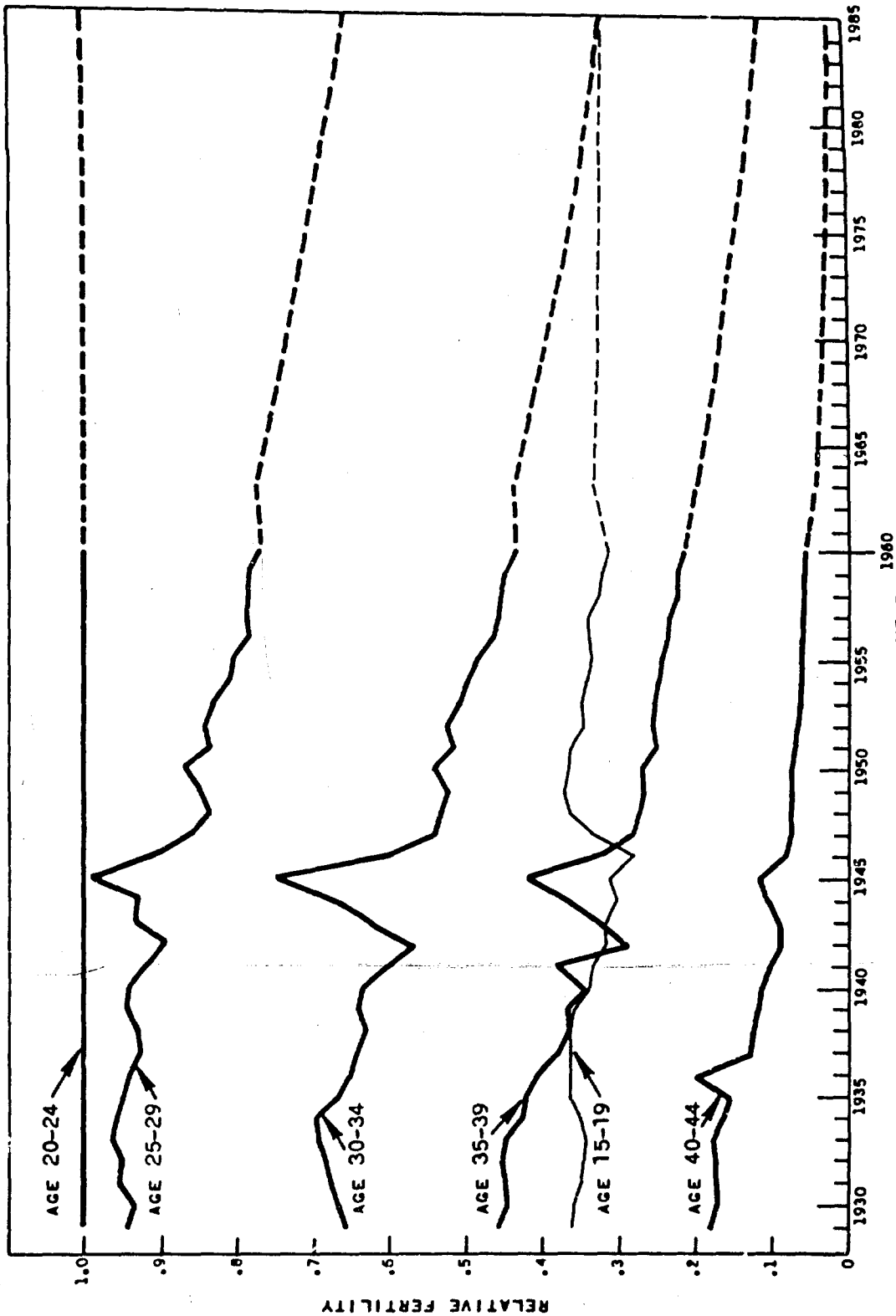
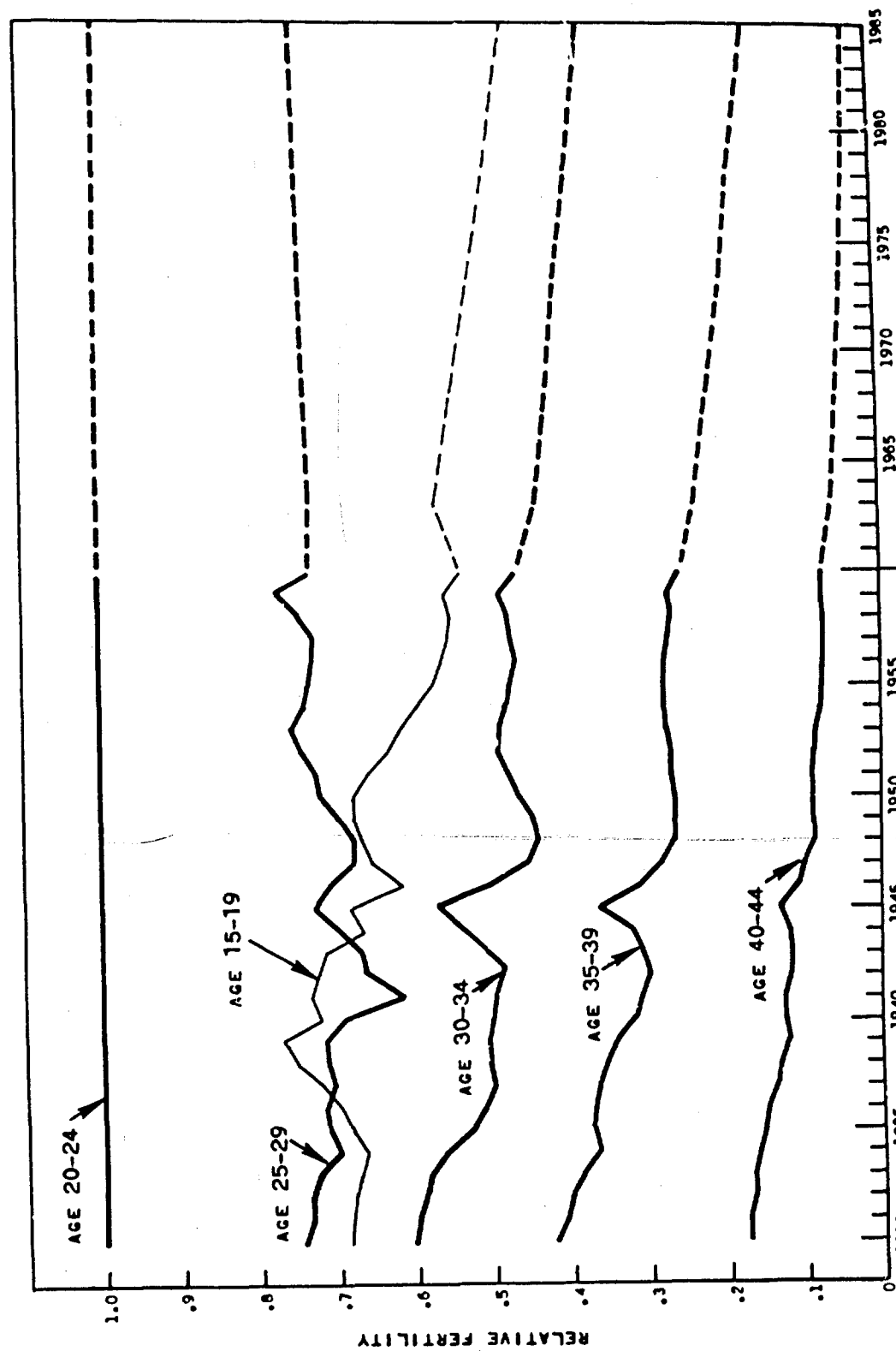


Fig. 5 - Fertility of Women 20-24 Years of Age, by Color: United States, 1930-1960



SOURCE: A. CHEVAN, PENN JERSEY TRANSPORTATION STUDY

Fig. 6 - National Trends in Fertility Differentials by Age: White Females, 1930-1985



SOURCE: A. CHEVAN, PENN JERSEY TRANSPORTATION STUDY

Fig. 7 - National Trends in Fertility Differentials by Age: Non-White Females, 1930-1985

Table 13

BIRTH RATES BY AGE AND COLOR OF MOTHER: 52 SMSA'S, 1960

A. Births per 1000 White Women, by Age

SMSA	15-44	15-19	20-24	25-29	30-34	35-39	40-44
AKRON	114.60	79.50	276.78	196.22	107.66	56.43	12.85
ALBANY	107.94	47.30	237.32	210.03	128.48	61.18	15.75
ATLANTA	106.44	97.61	220.16	167.07	93.73	39.67	12.06
BALTIMORE	105.52	77.48	236.43	193.18	105.02	47.36	13.25
BIRMINGHAM	98.96	81.79	226.20	156.90	90.51	35.37	8.46
BOSTON	112.23	42.06	212.47	222.41	139.68	67.64	18.15
BUFFALO	112.93	48.69	257.99	216.62	126.50	60.40	16.32
CHICAGO	112.13	57.67	244.96	211.11	122.47	59.18	14.24
CINCINNATI	124.47	85.06	242.23	210.96	129.93	65.19	19.22
CLEVELAND	106.48	51.90	236.55	206.52	119.59	54.37	15.64
COLUMBUS	118.97	88.86	237.48	195.71	102.94	49.29	12.79
DALLAS	108.61	112.17	233.39	165.09	85.95	40.86	9.55
DAYTON	114.50	88.72	260.41	186.51	103.55	44.94	13.78
DENVER	119.28	94.05	254.36	192.37	109.36	51.01	14.96
DETROIT	116.74	62.22	263.21	212.84	125.83	62.92	15.85
FORT WORTH	108.32	118.54	250.95	158.74	82.10	36.56	8.86
GARY	125.99	83.79	283.80	207.03	125.77	60.7[illegible]	17.09
HARTFORD	110.17	46.46	248.40	222.38	124.13	56.41	12.95
HOUSTON	111.66	104.21	250.60	172.21	96.37	45.08	11.71
INDIANAPOLIS	123.59	106.28	267.93	197.27	110.32	57.17	15.98
JERSEY CITY	98.88	47.23	223.98	182.73	110.64	52.92	13.71
KANSAS CITY	118.09	103.96	[illegible]7.67	190.63	101.89	52.78	12.86
LOS ANGELES	106.77	91.40	[illegible]1.12	179.36	97.87	45.25	11.79
LOUISVILLE	121.26	101.98	[illegible]67.06	194.42	104.84	52.74	15.18
MEMPHIS	100.87	89.[illegible]	225.34	153.44	83.84	41.00	8.58
MIAMI	88.79	69.[illegible]	222.11	162.57	86.70	37.81	9.09
MILWAUKEE	124.65	57.75	256.42	232.39	130.39	66.08	15.73
MINNEAPOLIS	133.87	61.14	251.54	242.31	145.30	71.29	20.86
NEWARK	96.20	38.06	211.67	204.95	117.84	54.71	12.78
NEW ORLEANS	113.47	84.24	254.53	196.12	108.02	46.78	13.93
NEW YORK	94.31	37.85	197.89	186.81	109.19	50.08	11.30
NORFOLK	125.65	122.18	269.34	193.95	98.34	52.19	10.67
OKLAHOMA CITY	111.49	112.96	246.87	159.83	84.17	40.97	9.91
PATERSON	95.20	31.65	220.39	208.83	118.05	52.87	13.05
PHILADELPHIA	105.29	47.90	225.96	210.32	121.87	57.50	13.22
PHOENIX	125.89	109.81	293.08	198.14	109.03	55.37	15.51
PITTSBURGH	100.77	51.38	221.06	197.15	117.57	54.55	14.00
PORTLAND	107.99	71.95	269.06	197.12	101.45	48.75	15.01
PROVIDENCE	104.85	48.95	233.45	212.02	120.76	60.29	13.21
ROCHESTER	110.04	44.96	233.77	223.90	129.10	58.35	14.94
SACRAMENTO	124.94	117.23	286.94	194.69	100.97	51.36	13.80
SAN ANTONIO	140.52	107.04	279.05	217.89	132.88	73.93	23.50
SAN BERNARDINO	123.75	116.56	289.73	194.97	99.80	47.88	14.62
SAN DIEGO	124.97	127.08	282.61	195.52	107.90	44.80	12.16
SAN FRANCISCO	103.45	77.71	237.61	181.91	101.40	46.63	12.06
SAN JOSE	124.34	85.77	269.22	216.45	113.23	55.50	15.83
SEATTLE	112.68	75.27	261.44	200.48	105.29	48.96	12.40
ST LOUIS	117.55	78.36	250.73	198.61	117.69	59.68	17.37
SYRACUSE	121.13	57.83	252.18	220.94	135.92	71.51	18.47
TAMPA	103.42	100.83	255.27	172.84	88.26	45.89	9.81
WASHINGTON,D.C.	108.43	69.11	223.80	198.08	117.25	56.28	16.36
YOUNGSTOWN	108.76	55.01	252.23	213.93	119.34	51.24	14.00

Table 13 -- continued

B. Births per 1000 Non-White Women, by Age

SMSA	15-44	15-19	20-24	25-29	30-34	35-39	40-44
AKRON	139.41	203.32	266.57	182.43	115.97	55.06	7.59
ALBANY	159.08	192.30	294.37	232.36	110.63	57.50	28.36
ATLANTA	141.08	176.00	246.01	183.44	115.56	48.34	17.19
BALTIMORE	151.87	196.30	303.03	197.85	122.22	61.41	14.06
BIRMINGHAM	140.20	135.56	286.55	194.13	131.39	70.43	22.40
BOSTON	146.44	162.00	289.65	206.26	110.29	65.49	15.62
BUFFALO	151.90	184.24	297.14	194.58	127.59	84.32	12.70
CHICAGO	161.62	203.20	308.89	215.75	132.38	66.93	17.99
CINCINNATI	142.00	170.84	270.47	204.25	129.36	68.14	14.55
CLEVELAND	132.20	160.73	263.64	194.70	105.35	51.87	12.55
COLUMBUS	150.32	174.43	307.28	194.78	119.60	56.76	16.26
DALLAS	168.44	242.26	317.69	203.28	122.19	55.47	14.83
DAYTON	136.44	142.30	280.05	208.64	106.66	61.07	10.30
DENVER	144.61	185.64	299.13	203.80	104.12	65.57	6.43
DETROIT	125.02	147.46	253.32	179.80	120.08	60.02	15.85
FORT WORTH	153.83	222.76	314.93	178.47	115.70	61.03	17.97
GARY	157.29	144.38	324.28	225.04	140.36	80.02	14.06
HARTFORD	139.89	170.82	235.69	192.52	113.14	58.46	23.73
HOUSTON	156.28	183.63	299.93	207.00	130.99	60.46	13.81
INDIANAPOLIS	163.93	220.18	317.64	213.81	146.68	58.14	25.83
JERSEY CITY	175.63	222.64	323.33	208.68	137.52	70.32	11.35
KANSAS CITY	175.08	240.18	339.69	250.87	141.07	64.50	19.54
LOS ANGELES	143.46	156.89	288.53	205.30	118.98	62.70	17.08
LOUISVILLE	157.62	211.93	323.68	226.27	123.76	68.13	18.11
MEMPHIS	170.59	193.11	330.84	239.59	131.51	76.13	18.46
MIAMI	162.42	213.59	296.57	204.85	129.67	65.99	13.14
MILWAUKEE	191.48	222.84	324.47	254.47	150.58	74.32	25.87
MINNEAPOLIS	168.54	180.57	332.28	232.59	152.57	55.38	16.15
NEWARK	133.61	157.84	268.60	181.61	102.61	50.11	12.49
NEW ORLEANS	163.75	176.04	314.74	228.93	144.79	70.75	19.71
NEW YORK	118.71	150.21	249.91	163.33	94.29	49.95	12.36
NORFOLK	149.32	182.88	313.00	203.74	133.73	61.20	19.00
OKLAHOMA CITY	182.2	210.52	347.92	223.70	146.19	81.53	27.79
PATERSON	136.24	171.90	262.20	179.06	104.79	45.52	6.31
PHILADELPHIA	132.92	167.27	269.05	186.56	109.30	54.52	13.89
PHOENIX	209.62	221.61	340.36	286.16	198.31	101.10	25.34
PITTSBURGH	131.08	144.44	271.95	195.84	109.92	57.10	18.43
PORTLAND	152.62	193.77	294.99	247.52	122.10	70.42	14.66
PROVIDENCE	172.90	157.89	364.91	243.81	98.68	104.85	18.47
ROCHESTER	174.39	233.96	308.48	206.61	116.55	75.91	20.71
SACRAMENTO	165.11	142.73	299.91	250.31	163.31	77.56	26.29
SAN ANTONIO	140.91	170.76	299.93	196.57	100.38	58.62	24.57
SAN BERNARDINO	184.02	208.75	336.00	234.08	149.79	85.91	12.94
SAN DIEGO	204.97	210.59	381.92	271.27	173.72	67.60	26.45
SAN FRANCISCO	140.26	159.32	275.03	208.85	129.96	64.53	18.34
SAN JOSE	152.82	82.26	247.19	258.29	174.18	77.71	35.20
SEATTLE	145.89	135.32	282.63	214.62	157.82	80.53	10.94
ST LOUIS	162.74	197.55	301.35	212.54	150.27	80.74	18.55
SYRACUSE	167.20	184.44	263.86	208.45	147.40	69.52	41.99
TAMPA	161.18	220.53	310.99	206.31	106.29	60.97	19.56
WASHINGTON,D.C.	140.68	183.40	276.41	196.66	111.40	58.39	16.04
YOUNGSTOWN	144.85	166.66	290.24	213.68	120.25	45.37	18.11

SOURCES: Vital Statistics of the United States, 1960; and U.S. Census of Population, 1960.

Table 14

RELATIVE FERTILITY BY AGE AND COLOR OF MOTHER: 52 SMSA'S, 1960

A. Age-Specific Birth Rates of White Women Expressed as Ratios to Central Age-Group

SMSA	15-19	20-24	25-29	30-34	35-39	40-44
AKRON	.288	1.000	.709	.389	.204	.047
ALBANY	.200	1.000	.806	.542	.258	.067
ATLANTA	.444	1.000	.759	.426	.181	.055
BALTIMORE	.328	1.000	.818	.445	.201	.057
BIRMINGHAM	.362	1.000	.694	.401	.157	.038
BOSTON	.198	1.000	1.047	.658	.319	.086
BUFFALO	.189	1.000	.840	.491	.235	.064
CHICAGO	.236	1.000	.862	.500	.242	.059
CINCINNATI	.352	1.000	.871	.537	.270	.080
CLEVELAND	.220	1.000	.874	.506	.230	.067
COLUMBUS	.375	1.000	.825	.434	.208	.054
DALLAS	.481	1.000	.708	.369	.176	.041
DAYTON	.341	1.000	.717	.398	.173	.053
DENVER	.370	1.000	.757	.430	.201	.059
DETROIT	.237	1.000	.809	.479	.240	.061
FORT WORTH	.473	1.000	.633	.328	.146	.036
GARY	.296	1.000	.730	.444	.215	.061
HARTFORD	.188	1.000	.896	.500	.228	.053
HOUSTON	.416	1.000	.688	.385	.180	.047
INDIANAPOLIS	.397	1.000	.737	.412	.214	.060
JERSEY CITY	.211	1.000	.816	.494	.237	.062
KANSAS CITY	.404	1.000	.740	.396	.205	.050
LOS ANGELES	.364	1.000	.715	.390	.181	.047
LOUISVILLE	.382	1.000	.729	.393	.198	.057
MEMPHIS	.396	1.000	.681	.373	.182	.039
MIAMI	.315	1.000	.732	.391	.171	.041
MILWAUKEE	.226	1.000	.907	.509	.258	.062
MINNEAPOLIS	.244	1.000	.964	.578	.284	.083
NEWARK	.180	1.000	.969	.557	.259	.061
NEW ORLEANS	.331	1.000	.771	.425	.184	.055
NEW YORK	.202	1.000	.945	.552	.254	.058
NORFOLK	.454	1.000	.721	.366	.194	.040
OKLAHOMA CITY	.458	1.000	.648	.341	.166	.041
PATERSON	.144	1.000	.948	.536	.240	.060
PHILADELPHIA	.212	1.000	.931	.540	.255	.059
PHOENIX	.375	1.000	.677	.373	.189	.053
PITTSBURGH	.233	1.000	.892	.532	.247	.064
PORTLAND	.268	1.000	.733	.378	.182	.056
PROVIDENCE	.210	1.000	.909	.518	.259	.057
ROCHESTER	.193	1.000	.958	.553	.250	.064
SACRAMENTO	.409	1.000	.679	.352	.179	.049
SAN ANTONIO	.384	1.000	.781	.477	.265	.085
SAN BERNARDINO	.403	1.000	.673	.345	.166	.051
SAN DIEGO	.450	1.000	.692	.382	.159	.044
SAN FRANCISCO	.328	1.000	.766	.427	.197	.051
SAN JOSE	.319	1.000	.804	.421	.207	.059
SEATTLE	.288	1.000	.767	.403	.188	.048
ST LOUIS	.313	1.000	.793	.470	.239	.070
SYRACUSE	.230	1.000	.877	.539	.284	.074
TAMPA	.395	1.000	.678	.346	.180	.039
WASHINGTON,D.C.	.309	1.000	.886	.524	.252	.074
YOUNGSTOWN	.219	1.000	.849	.474	.204	.056

Table 14 -- continued

B. Age-Specific Birth Rates of Non-White Women Expressed as Ratios to Central Age-Group

SMSA	15-19	20-24	25-29	30-34	35-39	40-44
AKRON	.763	1.000	.685	.436	.207	.029
ALBANY	.654	1.000	.790	.376	.196	.097
ATLANTA	.662	1.000	.690	.435	.182	.065
BALTIMORE	.648	1.000	.653	.404	.203	.047
BIRMINGHAM	.474	1.000	.678	.459	.246	.079
BOSTON	.560	1.000	.713	.381	.227	.052
BUFFALO	.553	1.000	.655	.430	.284	.043
CHICAGO	.658	1.000	.699	.429	.217	.059
CINCINNATI	.632	1.000	.756	.479	.252	.054
CLEVELAND	.641	1.000	.739	.400	.197	.048
COLUMBUS	.568	1.000	.634	.390	.185	.053
DALLAS	.763	1.000	.640	.385	.175	.047
DAYTON	.509	1.000	.746	.381	.215	.037
DENVER	.621	1.000	.682	.349	.220	.022
DETROIT	.583	1.000	.710	.475	.237	.063
FORT WORTH	.708	1.000	.567	.368	.194	.058
GARY	.446	1.000	.694	.433	.247	.044
HARTFORD	.725	1.000	.817	.481	.249	.101
HOUSTON	.613	1.000	.691	.437	.202	.047
INDIANAPOLIS	.694	1.000	.674	.462	.184	.082
JERSEY CITY	.689	1.000	.646	.426	.218	.036
KANSAS CITY	.708	1.000	.739	.416	.190	.058
LOS ANGELES	.544	1.000	.712	.413	.218	.060
LOUISVILLE	.655	1.000	.700	.383	.211	.056
MEMPHIS	.584	1.000	.729	.398	.231	.056
MIAMI	.721	1.000	.691	.438	.223	.045
MILWAUKEE	.687	1.000	.718	.465	.230	.080
MINNEAPOLIS	.544	1.000	.700	.460	.167	.049
NEWARK	.588	1.000	.677	.383	.187	.047
NEW ORLEANS	.560	1.000	.728	.461	.225	.063
NEW YORK	.602	1.000	.654	.378	.200	.050
NORFOLK	.585	1.000	.651	.428	.196	.061
OKLAHOMA CITY	.606	1.000	.643	.421	.235	.080
PATERSON	.655	1.000	.683	.400	.174	.025
PHILADELPHIA	.622	1.000	.694	.407	.203	.052
PHOENIX	.652	1.000	.841	.583	.298	.075
PITTSBURGH	.532	1.000	.721	.405	.210	.068
PORTLAND	.657	1.000	.840	.414	.239	.050
PROVIDENCE	.433	1.000	.669	.271	.288	.051
ROCHESTER	.759	1.000	.670	.378	.245	.068
SACRAMENTO	.476	1.000	.835	.545	.259	.088
SAN ANTONIO	.570	1.000	.656	.335	.196	.082
SAN BERNARDINO	.622	1.000	.697	.446	.256	.039
SAN DIEGO	.552	1.000	.711	.455	.178	.070
SAN FRANCISCO	.580	1.000	.760	.473	.235	.067
SAN JOSE	.333	1.000	1.045	.705	.315	.143
SEATTLE	.479	1.000	.760	.559	.285	.039
ST LOUIS	.656	1.000	.706	.499	.268	.062
SYRACUSE	.700	1.000	.791	.559	.264	.160
TAMPA	.710	1.000	.664	.342	.197	.063
WASHINGTON,D.C.	.664	1.000	.712	.404	.212	.059
YOUNGSTOWN	.575	1.000	.737	.415	.157	.063

SOURCE: Calculated from data in Table 13.

These speculations can only be confirmed by analysis of cross-section data, since time-series for fertility in specific SMSA's are not generally available.

Of these three elements of differential fertility, I have projected changes only for the second. It is assumed that the 20-24 year age-group in each SMSA will maintain its 1960 level of fertility, and that the 1960 pattern of geographic differentials will persist. Projections of the second element were made as follows:

Age-specific birth rates for white and non-white females in the United States, expressed as ratios to the birth rates of the central age-group of each race, 1929-1960, were projected along first-degree exponential curves fitted to the historical data. (Both the historical series and the projections appear in Figs. 6 and 7, and the projected values of these ratios for the mid-points of each quinquennium, 1960-1985, appear in Table 15.) Future age-specific birth rates for each SMSA were then calculated so as to maintain geographic differentials in age-specific fertility while altering the actual birth rates in the pattern suggested by Table 15. The computational formula was:

$$B_{ijm} = \frac{B_{ij1} R_{ijm}}{R_{ij1}}$$

where:

B = births per 1,000 women per year in a given SMSA;

R = ratio of national age-specific fertility rates to the fertility rate of the central age-group, 20-24 years;

i = an age-group of adult females;

j = an ethnic group (white, non-white);

m = year of projection (1960 = 1).

The reader may calculate the age-specific birth rates projected for any SMSA by substituting the appropriate entries in Table 13 for B_{ij1} and the appropriate entries in Table 15 for R_{ijm} and R_{ij1}.

Table 15

PROJECTED RELATIVE FERTILITY BY AGE AND COLOR OF MOTHER: UNITED STATES, 1960-1985

Color and Age Group	Age-Specific Birth Rates Expressed as Ratios to Central Age-Group					
	15-19	20-24	25-29	30-34	35-39	40-44
White Females						
1960 (actual)	.334	1.000	.778	.457	.213	.051
1960-1965	.332	1.000	.774	.439	.199	.046
1965-1970	.328	1.000	.745	.407	.175	.037
1970-1975	.325	1.000	.717	.376	.154	.030
1975-1980	.322	1.000	.691	.348	.135	.024
1980-1985	.319	1.000	.665	.323	.118	.020
Non-White Females						
1960 (actual)	.579	1.000	.727	.448	.244	.066
1960-1965	.567	1.000	.729	.439	.234	.060
1965-1970	.544	1.000	.733	.423	.216	.051
1970-1975	.522	1.000	.737	.408	.199	.043
1975-1980	.500	1.000	.741	.393	.184	.037
1980-1985	.480	1.000	.745	.378	.169	.031

Source: A. Chevan, Penn-Jersey Transportation Study.

MORTALITY ASSUMPTION 1

Briefly, I have assumed that death rates for virtually all components of the population would decline over the period of these projections. This assumption is based on the history of national rates by age, sex, and color during the past 30 years. For whites, future age-specific death rates decline at roughly one-half their average annual rate of decrease, 1930-1959. For non-whites, the projected rates of decline are about 75 per cent of the corresponding rates, 1930-1959.

Just as for fertility, three elements of differential mortality, all relevant to these projections, present themselves:

1) Short-run fluctuations in general mortality, closely

associated with epidemic diseases or other catastrophes. Presumably because of the spread of public health measures and of professional medical care, such fluctuations are now relatively unimportant in the nation as a whole, although they may still have local significance. The last national fluctuation of importance occurred with the influenza epidemic of 1918. (See Fig. 8.)

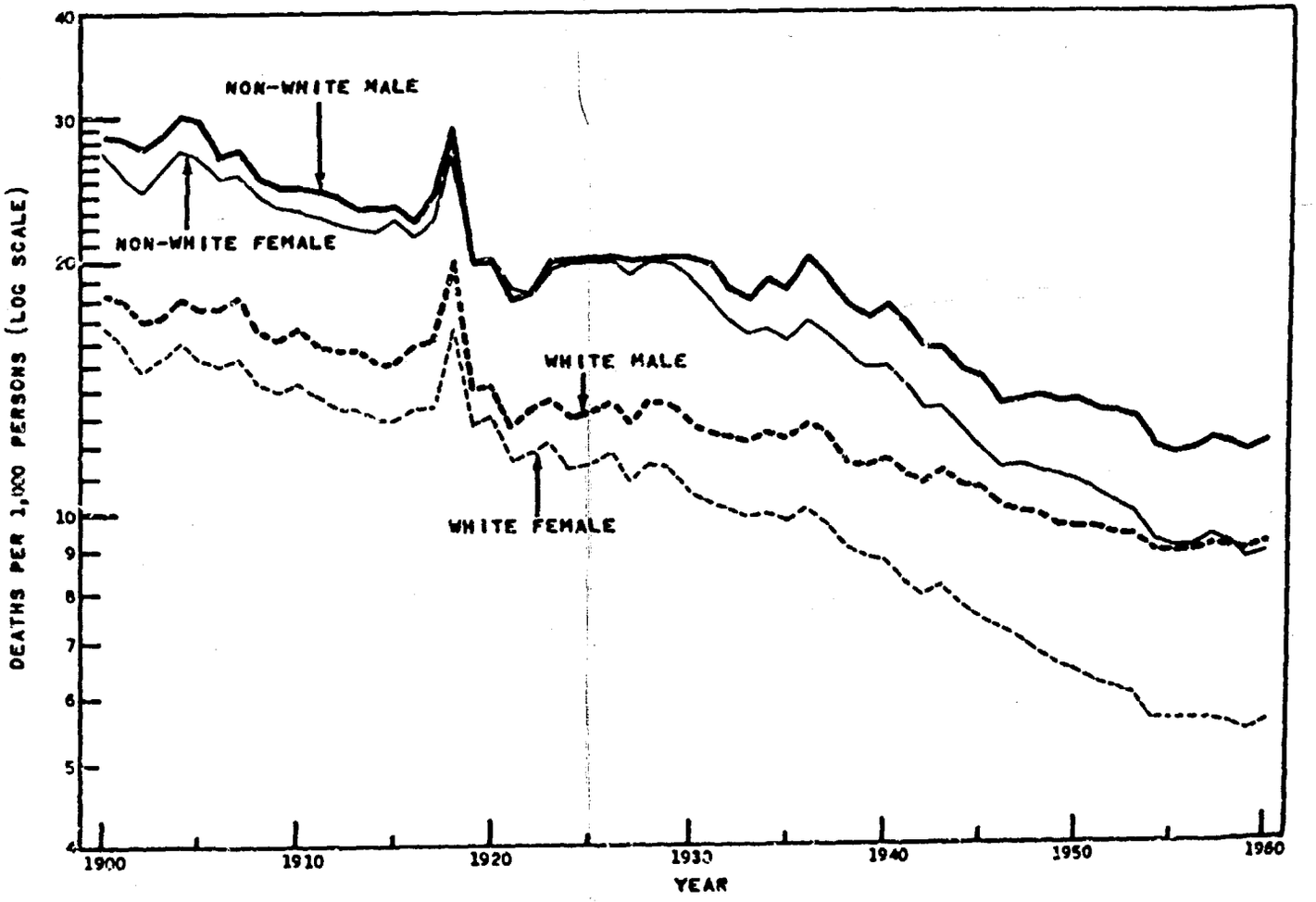
2) Long-run trends in age-specific death rates. The minor fluctuations just described do little to obscure the persistent downward drift of age-specific death rates for virtually all components of the national population. While marked differences in these rates for males and for females exist, all the groups mentioned have participated in the general trend toward greater life-expectancy. Figure 9 shows age-specific death rates for white males since 1900.

The greatest reductions in mortality have occurred among the youngest age-groups. Infant mortality (under 1 year) among whites fell from 93 per 1,000 live births in 1915-1919 to 23 in 1960; among non-whites, the corresponding rates were 150 and 44.* Though smaller in absolute magnitude, the reduction in mortality has been relatively even greater for the 1-4 year age-group. Beyond age five, however, the rate of decrease in mortality is inversely related to age, and the changes during the past half-century in death rates for persons over 60 are quite small. Although great strides have been made in nutrition and in the control of infectious diseases, relatively little progress has been made in arresting the degenerative processes of old age.

3) Geographical differentials in the structure of age-specific death rates. At present, no thorough study of local differences in mortality within the United States exists. Standard life-tables have a national basis,** and national death rates are

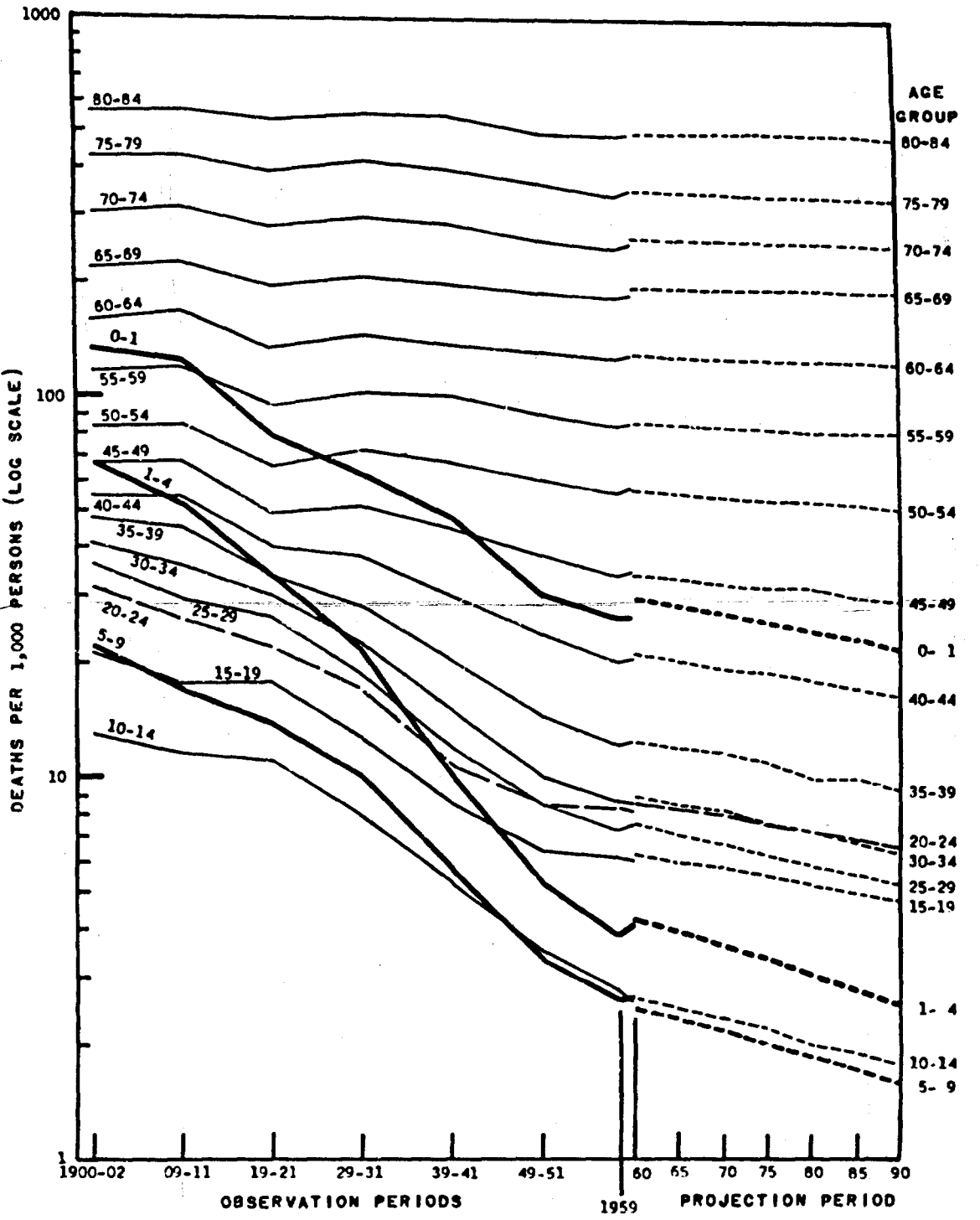
*Vital Statistics of the United States 1960, Vol. II, Table 3A.

**The National Vital Statistics Division currently has under way



SOURCES: 1900-1932: NVSD, DEATH REGISTRATION STATES
1933-1960: NVSD, UNITED STATES

Fig. 8 - Age-adjusted Death Rates by Color and Sex: United States, 1900-1960



SOURCES: 1900-1960, NVSD
1960-1990, A. CHEVAN, PENN JERSEY TRANSPORTATION STUDY

Fig. 9 - Five-year Death Rates for White Males, by Age: United States, 1900-1990

widely used for local population analysts. Actuaries with whom I have discussed this topic insist that local variations in death rates (when these are specific to age, sex, and color) are relatively unimportant and will be ever less important in the future.

Although I feel that geographic differentials in mortality require further investigation, for this set of projections I rely on a single set of death rates, specific to age, sex, and color, extrapolated from national trends, 1930-1959, for each group. Examples for white males only appear in Fig. 9.

As indicated in the introductory paragraph of this section, age-specific rates for white males and for white females were diminished from their 1959 values at a rate equal to one-half the average rate of decrease, 1930-1959. Age-specific rates for non-white males and for non-white females were diminished from their 1959 values at a rate equal to three-fourths of the average rate of decrease, 1930-1959. These projections imply convergence between white and non-white death rates, but not between male and female death rates.

This extrapolation may be described algebraically as follows:*

$$D_{ijm} = D_{ij0} - a_j \, x_{ij}{}^m \, D_{ij0}$$

or

$$D_{ijm} = (1 - a_j x_{ij}{}^m) \, D_{ij0}$$

where:

D = deaths per 1,000 persons per year in the United States;

i = an age-group;

j = an ethnic group (white, non-white);

m = year of projection (1959 = 0);

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a project to construct life tables for each of the 24 largest SMSA's, based on 1959-1961 data.

*The method actually used for computations differed slightly from that suggested by this formulation.

x = the average annual rate of decrease in the death rate, 1930-1959;

a = a given parameter (0.50 for whites, 0.75 for non-whites).

A number of side-conditions were imposed on the projected rates:

a) For ages below 75 years, non-white rates were not permitted to drop below white rates for the corresponding age/sex group.

b) At ages 75 and above, non-white rates were not changed from their rather low levels, 1957-1959.

c) At ages 65-69 and 70-74, for non-white males, the record shows a slight increase in mortality between 1930-1932 and 1957-1959. Rates for these two groups were diminished linearly so as to reach the 1930-1932 levels by 1990.

d) Infant mortality among non-whites was diminished at the same rate as prevailed between 1930 and 1959 (rather than at three-fourths of that rate, as was done for other age-groups of non-whites).

The death rates generated by this procedure are slightly higher for 1960 than those computed by the National Vital Statistics Division--probably because intercensal population estimates (used in calculating 1957-1959 rates) were too low. The projected mortality series as a whole is very close to that presented as the "low-mortality assumption" in T.N.E. Greville's Illustrative United States Population Projections.*

MIGRATION ASSUMPTION 1

For RAND Series I projections, I assume zero net migration. The assumption may be interpreted as implying no migration whatever--i.e., that the population of each SMSA is "closed"--or as implying an "open" population with an exact balance between in- and out-migration for each age/sex/color group.

Certain inconsistencies should be noted, however, in projecting natural increase for a closed population, when vital rates are based on

*Actuarial Study No. 46, U.S. Social Security Administration, May 1957.

experience with an open population. Birth rates, for example, are highly contingent on marriage rates, and these depend in part on age-specific sex ratios. Migration is notoriously selective of particular age/sex groups, so that historical fertility rates in each SMSA reflect the influence of the coordinate pattern of migration. While there are doubtless analogies to this problem in connection with death rates, the use of national mortality data for this projection series is tantamount to the assumption of a closed population, and is therefore reasonable for the present series.

The machine-printed population tables (not included with this report) acknowledge the problem discussed above only by calling attention to instances in which emergent age-specific sex ratios deviate by more than 20 per cent from the corresponding sex ratios of 1960--the year which served as the bench-mark for projection of birth rates. No attempt was made to modify these birth rates to reflect the implicit change in the probabilities of marriage resulting from a relative superfluity or shortage of men in a given age-bracket.

MIGRATION ASSUMPTION 2

For RAND Series II projection, I assume quinquennial net migration, 1960-1985, for each age, sex, and color group in the amount of one-half the flow estimated for that group, 1950-1960. In each iteration of the projection, this schedule of quinquennial net migration joins the population base, selectively increasing or diminishing its various components. Subsequent iterations age these altered components and subject them to vital rates, so that the projections program encompasses both direct and indirect consequences of migration. Comparing the projections of Series II with Series I, which assumed zero net migration for all components of the population, shows the total effect of Migration Assumption 2 on the projected population.

In order to allow for migration in component population projections, it is necessary to have estimates of the numbers of net migrants at the same component level of detail--i.e., by five-year age groups, sex, and color. Net migration is the balance for any component, between in-migrants and out-migrants to the SMSA in question.

The United States has no direct reporting system for migration,* but various indirect methods for estimating net flows have been devised:

Vital Events Method. Adding recorded births to and subtracting recorded deaths from an enumerated initial population permits estimation of the "expected" terminal population. This expected population can then be compared to the "actual" population enumerated by a census at the terminal date. The difference (actual minus expected) is interpreted as net migration.

Vital Rates Method. The Vital Rates Method resembles the Vital Events Method, except that fertility and mortality rates are applied to the initial populations to obtain estimates of births and deaths over the period in question. Obviously if a complete record of vital events is available, the first method is appropriate; when vital rates are used, they are either bench-mark estimates (e.g., for census years only) or are based on a somewhat different population than that for which the migration estimates are desired (e.g., national mortality rates may be applied to local populations for which life tables are lacking).

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*Decennial censuses have included questions about former place of residence which have been of use in the study of in-migration and its sources. With the adoption by the Bureau of Census of electronic data-processing techniques, it has also become feasible to compile from these responses figures on out-migration from a given area. Two reports released by the Bureau in the fall of 1963 (Mobility for Metropolitan Areas, and Mobility for States and State Economic Areas) provide the first such data for the period 1955-1960.

These figures might have been used in the present study; however, they are based on a shorter time-span, a 25-per-cent sample of respondents, and include a relatively large number of movers who failed to report their previous places of residence. The asymmetry of the techniques used in estimating in-migration and out-migration leaves one with a sense that the resulting estimates of net migration are less reliable than those derived by the indirect methods described in the text. A any rate, it is clear that estimates derived from the previous place-of-residence data differ substantially in pattern from those derived by indirect methods; if the differences are not attributable to estimating biases, they may reflect changes during the decade in the flows of migration.

Census Survival Method. A census survival rate is simply the ratio between the numbers of persons belonging to a given population cohort, as enumerated at successive censuses. If the population is "closed"--i.e., cannot be increased or diminished by migration--the rate reflects the combined effects of mortality and errors or biases in the enumeration procedures of the two censuses. The Bureau of the Census has calculated census survival rates for 1950-1960 for the native white and native non-white populations of the United States, for five-year cohorts, by sex. Since the "native population among the Armed Forces and civilian Federal employees abroad, their dependents, and crews of merchant vessels" appear in both initial and terminal populations, nearly complete closure is attained.

If one is willing to dismiss local differences in mortality (specific for age, sex, and color) and local differences in enumeration and reporting biases, these national census survival rates may be applied to local populations to estimate the "expected" intercensal change in each cohort in the absence of migration. The difference between "expected" and actual populations at the terminal census date can then be attributed to migration.

The method has two advantages: it requires a minimum of local data, and it does not mix data from different reporting systems. One difficulty with the use of vital statistics in connection with population counts from decennial censuses is that each data-source has its own peculiar biases. In the census, there is evidence of persistent under-enumeration of certain components of the population, and also of characteristic biases in age-reporting. The Census Survival Method tends to compensate for these errors, although it does not allow for local variations in enumeration biases, nor in mortality rates.*

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*The method and its problems are discussed in C. Horace Hamilton and F. M. Henderson, "Use of the Survival Rate Method in Measuring Net Migration," Journal of the American Statistical Association, Vol. 39, June 1944, pp. 197-206; and Jacob S. Siegel and C. Horace Hamilton, "Some Considerations in the Use of the Residual Method of Estimating Net Migration," Ibid., Vol. 47, September 1952, pp. 475-500.

Despite recent improvements in the reporting and processing of vital statistics at the national level, component detail is not readily available for individual metropolitan areas for all recent years; consequently, the Vital Events and Vital Statistics Methods are difficult to apply to such areas. For the period 1940-1950, however, Donald J. Bogue tabulated total births (adjusted for under-enumeration) and total deaths for each of 149 large Standard Metropolitan Areas, and used these data to estimate total net migration by the Vital Events Method; he also prepared estimates of the components of net migration to each SMA, using the Census Survival Method. In 1962, the Bureau of the Census published estimates of total net migration for all SMSA's, 1950-1960, again using the Vital Events Method. In the same publication, they included Bogue's estimates for the preceding decade, adjusted for changes in SMA-SMSA boundaries.*

These estimates of total net migration, 1940-1950 and 1950-1960, are shown in Table 16 for the 52 SMSA's covered by the present report. While the migration flows of the two decades are in many instances of the same order of magnitude, there is no evident consistency in either absolute volume or rate of flow. All things considered, the table offers little encouragement for the notion of using recent history as a basis for predicting future migration flows to individual SMSA's. However, for RAND's Series II projections, the 1950-1960 absolute volumes were chosen as being of more interest than other accessible alternatives. A more analytical approach to migration is contemplated for future projection series.

As I have indicated, the population projection method calls for component detail, rather than simply total net migration. For this reason, the Census Bureau's estimates could not be used directly;

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*Donald J. Bogue, Components of Population Change, 1940-1950: Estimates of Net Migration and Natural Increase for Each Standard Metropolitan Area and State Economic Area, Scripps Foundation Studies in Population Distribution Number 12, Oxford, Ohio, 1957; and U.S. Bureau of the Census, Components of Population Change, 1950 to 1960, for Counties, Standard Metropolitan Statistical Areas, State Economic Areas, and Economic Subregions, Current Population Reports Series P-23, No. 7, November 1962. See p. 21 above for the distinction between Standard Metropolitan Area and Standard Metropolitan Statistical Area.

Table 16

NET MIGRATION TO 52 SMSA's, 1940-1950 AND 1950-1960

	Net Migration, 1940-1950		Net Migration,[b] 1950-1960	
	Number	Rate[a]	Number	Rate[a]
AKRON	18466	9.5	24564	6.0
ALBANY	25497	4.8	1172	0.2
ATLANTA	72668	13.0	123878	17.0
BALTIMORE	122551	10.8	87152	8.2
BIRMINGHAM	24279	5.3	-25413	-4.5
BOSTON	-2162	-0.1	-103082	-3.6
BUFFALO	35742	3.8	43914	4.0
CHICAGO	162129	3.5	251113	4.8
CINCINNATI	34166	4.3	17237	1.9
CLEVELAND	52793	4.2	90535	6.2
COLUMBUS	57841	14.9	75756	15.0
DALLAS	122518	23.1	169488	22.8
DAYTON	74319	19.4	63333	12.3
DENVER	99538	22.3	185343	30.3
DETROIT	252452	10.6	92265	3.1
FORT WORTH	89753	34.9	86395	22.0
GARY	35150	11.C	64636	15.8
HARTFORD	33225	7.4	60559	11.2
HOUSTON	168253	31.8	212029	26.3
INDIANAPOLIS	34869	7.4	36441	6.6
JERSEY CITY	-53757	-8.3	-98243	-15.2
KANSAS CITY	58273	8.5	75484	9.3
LOS ANGELES	1087532	37.6	1582670	36.2
LOUISVILLE	59880	13.2	32550	5.6
MEMPHIS	74487	20.9	35152	7.3
MIAMI	188145	70.3	346793	70.0
MILWAUKEE	36062	4.4	67570	7.1
MINNEAPOLIS	48988	5.0	92428	8.0
NEWARK	61009	4.7	43040	3.0
NEW ORLEANS	46768	8.4	42362	6.2
NEW YORK	155299	1.8	99246	1.0
NORFOLK	131208	51.1	18716	5.0
OKLAHOMA CITY	38944	12.8	37747	9.6
PATERSON	87260	12.2	180215	20.6
PHILADELPHIA	172358	5.4	168923	4.6
PHOENIX	102330	54.8	234327	70.6
PITTSBURGH	-91177	-4.4	-109030	-4.7
PORTLAND	140476	28.3	26817	3.8
PROVIDENCE	-9477	-1.5	-40513	-5.9
ROCHESTER	15132	3.5	30100	6.2
SACRAMENTO	82451	48.7	158360	57.1
SAN ANTONIO	79773	23.6	42308	8.4
SAN BERNARDINO	142512	53.7	252434	55.9
SAN DIEGO	199548	69.7	325847	58.5
SAN FRANCISCO	549282	37.3	194694	8.7
SAN JOSE	87894	49.0	271082	93.3
SEATTLE	163832	27.5	124056	14.7
ST LOUIS	108512	7.4	48403	2.8
SYRACUSE	21344	5.3	24427	5.2
TAMPA	106445	39.3	313592	76.6
WASHINGTON,D.C.	301597	30.8	205467	14.0
YOUNGSTOWN	1975	0.5	19378	4.6

SOURCE: U.S. Bureau of the Census and D. J. Bogue (see p. 75).

[a]Migration as percentage of SMSA population at beginning of period.

[b]Figures shown are Vital Events estimates, which differ slightly from Census Survival estimates prepared by the author and used in RAND Series II projections. See Table 17 for comparisons.

instead, I have estimated 60 age/sex/color components of the 1950-1960 flows of net migration, using the Forward Census Survival Method with national census survival rates computed by the Bureau of the Census.

Migration of persons under ten years of age in 1960 was estimated by the application of census survival rates to births reported during the decade for each SMSA. Since component detail for births was not obtainable for individual SMSA's, the totals tabulated by the Bureau of the Census were allocated by sex (on the basis of prevailing sex ratios at birth) and by color (on the basis of each SMSA's population of potential mothers, white and non-white, and their age-specific fertilities). The allocated births were then "survived" to obtain the expected 1960 populations of persons under ten years of age, by sex and color. The residual estimates of net migration for this group were then allocated one-third to migrants under five years of age and two-thirds to migrants five to nine years of age.

Migration of persons ten years of age and older was estimated by applying the national census survival rates to the 1950 populations of each SMSA, classified by five-year age-groups, sex, and color. The "expected" survivors were compared to the populations enumerated by the 1960 census for the same cohort (i.e., of the same sex and color, but ten years older), and the differences were attributed to net migration.

Since these estimates of net migration represent differences between much larger magnitudes, they are intrinsically unstable. Relatively small errors in the counts of initial or terminal populations, or in survival rates, show up as relatively large errors in the net migration estimates. While we have no standard for judging the accuracy of our estimates of individual components of each SMSA's migratory flows, we are able to compare our "total net migration" to the Vital Events estimate prepared by the Bureau of the Census. By this standard, the Census Survival Method tends to understate in-migration and overstate out-migration. Although the negative bias is persistent, the margin of error is large only when the migration flow itself is small relative to the base population.

To correct for this negative bias, a slight downward adjustment

was made in the census survival rates, and the components of net migration were recalculated.* Interestingly enough, all southern SMSA's were better fitted by the original census survival rates, while the adjusted rates worked better for virtually all other SMSA's. I chose the version whose total most nearly agreed with that of the Bureau of the Census. As the comparisons in Table 17 will show, only Albany failed to respond to this treatment, and in this case, the magnitudes involved are negligible.

A review of the details of these estimates for individual SMSA's contributes to my sense that they are reasonable approximations to the actual migratory flow of the 1950's. Although nearly every schedule of migrants contains an entry or two that are implausible, the general patterns accord with other information about recent metropolitan population changes. The main currents of migration are westward; in most northeastern cities, white out-migration is partially or wholly compensated by non-white in-migration; SMSA's in the north tend to export elderly persons to warmer climates; and SMSA's in economically depressed areas tend to lose young adults. There are technical reasons for supposing that the estimates are most reliable for central age-brackets, least reliable for children and elderly persons.

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*The usual method of reconciling small differences between two estimates is deflation of the components by the ratio of the totals. But there is very little logic to this technique when the components include both positive and negative values; and if the totals themselves have different signs, the method is unworkable. In this case, I subtracted .01 from each census survival rate; the amount is arbitrary, but seems to do the trick.

Table 17

COMPARISONS OF ESTIMATES OF NET MIGRATION, 1950-1960, FOR 52 SMSA'S

SMSA	Estimated Net Migration: Vital Events	Estimated Net Migration: Census Survival	% Difference	Net Migration[a] as % of 1960 Population
AKRON	24564	27699	12.76	4.78
ALBANY	1172	-5060	-531.73	0.17
ATLANTA	123878	120729	-2.54	12.17
BALTIMORE	87152	88662	1.73	5.04
BIRMINGHAM	-25413	-24865	-2.16	-4.00
BOSTON	-103082	-102406	-0.66	-3.31
BUFFALO	43514	42133	-3.17	3.32
CHICAGO	251113	254428	1.32	4.03
CINCINNATI	17237	17460	1.29	1.60
CLEVELAND	90535	95648	5.65	5.03
COLUMBUS	75756	78363	3.44	11.09
DALLAS	169488	169179	-0.18	15.64
DAYTON	63333	66742	5.38	9.11
DENVER	185343	186986	0.89	19.94
DETROIT	92265	80259	-13.01	2.45
FORT WORTH	86395	84296	-2.43	15.07
GARY-HAMMOND	64636	66983	3.63	11.26
HARTFORD	60559	57867	-4.45	8.78
HOUSTON	212429	209481	-1.20	17.05
INDIANAPOLIS	36441	37870	3.92	5.22
JERSEY CITY	-98243	-101808	3.63	-16.08
KANSAS CITY	75484	79653	5.52	7.26
LOS ANGELES	1582678	1597662	0.95	23.47
LOUISVILLE	32550	32052	-1.53	4.48
MEMPHIS	35152	36348	3.40	5.60
MIAMI	346793	343060	-1.08	37.08
MILWAUKEE	67570	71954	6.49	5.65
MINNEAPOLIS	92428	88348	-4.41	6.23
NEWARK	43040	47248	9.78	2.54
NEW ORLEANS	42362	43707	3.17	4.87
NEW YORK	99246	112065	12.92	0.92
NORFOLK	18716	16921	-9.59	3.23
OKLAHOMA CITY	37747	38910	3.08	7.37
PATERSON	180215	182005	0.99	15.18
PHILADELPHIA	168923	167541	-0.82	3.88
PHOENIX	234327	232226	-0.90	35.31
PITTSBURGH	-105030	-101356	-3.50	-4.36
PORTLAND	26817	30972	15.49	3.26
PROVIDENCE	-40513	-40115	-0.98	-5.63
ROCHESTER	30100	32748	8.80	5.13
SACRAMENTO	158360	156440	-1.21	31.49
SAN ANTONIO	42308	45219	6.88	6.15
SAN BERNARDINO	252434	250978	-0.58	31.17
SAN DIEGO	325847	327729	0.58	31.54
SAN FRANCISCO	194694	208032	6.85	6.99
SAN JOSE	271082	271954	0.32	42.20
SEATTLE	124056	127947	3.14	11.20
ST. LOUIS	48403	55472	14.60	2.34
SYRACUSE	24427	23606	-3.36	4.33
TAMPA	311592	304995	-2.74	40.59
WASHINGTON	205467	204960	-0.25	10.26
YOUNGSTOWN	19378	21520	11.06	3.80

SOURCES: Vital Events estimates, U.S. Bureau of the Census; Census Survival estimates, The RAND Corporation.

[a]As estimated by the Vital Events Method.